VOL. LXXXII. No. 2100. [All Rights Reserved.] FEBRUARY 22, 1918. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of Postage.] PRICE FOURPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C.4. SUBSCRIPTION per annum. Postage inclusive, in Great Britain, £1 1s. 8d. Canada, £1 3s. 10d. ($5.80); to all other countries, 30s.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
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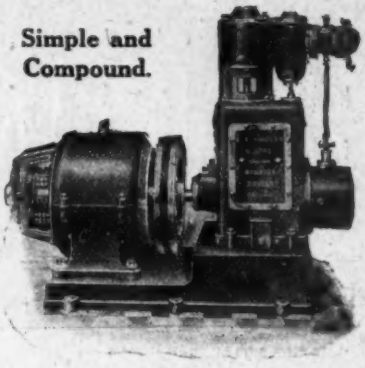

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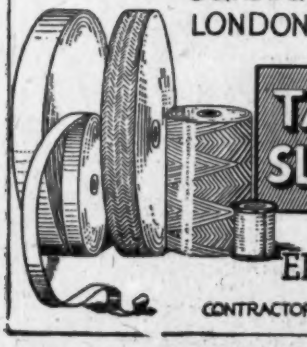

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THE

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ELECTRICAL REVIEW.

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Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

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Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

INDUSTRIAL COMBINATION.

WE cannot say that we cordially approve of the manner in which the Government is divulging the contents of the reports of the Committees that sat to investigate the position of the electrical, engineering, iron and steel, and other trades. As our readers are aware, the decision to give publicity to these reports in their complete form has not yet been arrived at, but they are appearing in "bits" in the Board of Trade *Journal*. We can quite understand that it may be regarded as necessary in the interests of National or Allied policy to hold up certain recommendations until a more suitable occasion, but the piecemeal method that is being followed at present is far from being satisfactory. We do not say that it is uninteresting to see where there is agreement between the different committees respecting such matters as standardisation and combination, for, of course, by means of these comparative statements we may be enabled to decide where a general policy common to them all or to several of them might be applicable. But the present practice will leave us always in doubt as to whether we have had all that ought to be vouchsafed to us. So far as the electrical and engineering trades reports are concerned, we hope it will be possible to publish these as separate documents, even if it has to be indicated that certain matters are withheld for a time in the public interest.

A week ago we referred in our "Notes" to the first edition of extracts which showed the need for combination amongst our manufacturers in order to secure the extension of standardisation, and to the necessity for their adjusting themselves to meet the requirements of foreign markets where accessories of types that they do not make hold sway. On another page to-day we quote from the Board of Trade *Journal* some further extracts which we deem of great importance to our readers. The argument in favour of combination and co-operation between British electrical companies and firms for the promotion of export trade is very familiar to readers of the ELECTRICAL REVIEW, and the various steps that have been taken during the past few years in such a direction by a number of battery, motor, and switchgear firms have been recorded here. It is many years ago now since we first placed before the trade the pressing need that existed in certain markets for combined action to enable the British electrical trade to stand up against the strong competitive efforts of Teutonic organisations. Such combination or co-operation was urged not merely in respect of selling organisation, but also in respect of manufacturing. A few years ago it was common knowledge that our isolated manufacturing efforts in certain lines led to suicidal competition which was quite as harmful as the unhindered competition of foreign traders. Happily, the development of the spirit of co-operation and a better organisation within the industry at home led to considerable improvement in this respect. But if we accept the conclusions of the Electrical Trades Committee we have still a long way to go, both in co-operative manufacturing and in co-operative selling, before we can consider that we are established in effective strength to resist after-war onslaughts which present enemies are preparing to make upon whatever markets will admit them. As the Committee state in the section of their report now published, the serious competition which British exporters have to face is almost entirely with the two or three big German organisations which for years past have

consistently followed the amalgamation and association policy so as to resist ourselves and all other comers. The immense resources of these concerns, their highly-trained staffs, their branches established all over the world, and their elaborate research organisations made possible by the large extent of their operations, were understood here before the war, and their enormous financial strength through their close working arrangements with the leading financial institutions on the Continent was recognised as a factor which it was almost impossible for us to meet successfully under the unaccommodating and inelastic financial system that existed here. It will be observed that the Committee makes a comparison of the Teutonic policy of combination with our own disposition to discourage combination, greatly to the disadvantage of the traders of this country. A few weeks ago, when representatives of the Government trade departments were delivering speeches in some of the industrial centres urging certain trades to combine or be prepared to go under, we supported that advocacy. The report of the Electrical Trades Committee abundantly supports the combination speeches. Amalgamation or association for common purposes is regarded as the basis on which a sound and permanent industry can be established, and only by the creation of strong combinations will it be possible for Great Britain to compete with the great foreign corporations. It is obvious from a good deal that is being said that the Government recognises such combinations as essential. Some evidence to this effect appears in the terms of reference with which the Minister of Reconstruction has appointed his latest Committee:—"In view of the probable extension of development of trade organisations and combinations, to consider and report what action, if any, may be necessary to safeguard the public interest." The combinations that we advocate have to do with the engineering and electrical trades, not with food, and such like. The new Committee will consider the effects of the application of the principle to all trades. Labour is represented on the Committee, and we have no doubt that from the inquiry it will learn a great deal of very useful information respecting the difficulties of industrial management and international trade.

Industrial Reconstruction.

The first public meeting of the Industrial Reconstruction Council, which took place on Friday last in the Guildhall Council Chamber, was a memorable war-time event. The piece of business that the Council has formed itself to undertake is obviously regarded as important by the powers in authority, or Lord Burnham, Dr. Addison (Minister of Reconstruction), Mr. G. H. Roberts (Minister of Labour), and Mr. J. H. Whitley, M.P. (Chairman of the Whitley Report Committee), would not have been there. After all that we have already published regarding the objects of the Council, and reflecting the views of Dr. Addison and Mr. Roberts concerning the need for making preparations which shall encourage more harmonious relations between employer and employed in the post-war period, we need not refer to the speeches at length, but there are one or two incidents or features which required comment. After we had recovered from the cold douche of the Lord Mayor, who reminded us that we were still at war—as though we were likely to forget it in these critical months—Dr. Addison said that the carrying out of all our preparations for the future depended fundamentally upon our being able to pay for them, and the governing consideration was, therefore, the increased production of wealth. Employers and employed must co-operate in increasing production or "distress must be our lot." "Unless we have Industrial Peace none of these things can be added unto us." We must so arrange our affairs that one man or one shop must not be able to throw a whole industry into confusion. Whitley Councils should go a good way toward avoiding trouble. No organisation of employers or workmen, said Dr. Addison, can help industry by promoting civil war, or by the manipulation of prices so that they keep their customers poor. "They cannot help industry by bolstering up inefficiency in any form. They cannot help a man who will not help himself. They ought not to try to regulate the pace by the pace of the slowest. They ought not to encourage inefficiency in any way. They ought not to fetter any man's freedom to make the best use of his own skill and brains." Familiar truths—wholesome truths—these, but very necessary for both sides to remember as we set out upon our new industrial era. The Council receives the Governmental blessing largely because it designs to help industries to help themselves.

Mr. Roberts's speech was delivered in his usual effective style, and contained some of that sound sense which is so essential to the encouragement of reason when industrial revolution appeals to the passions of violent sections. He was careful to remark in this connection that sure progress only flows from slow modifications of an existing order, and he was deliberate in his expression of feelings of strong opposition to those who "would lead my class into the portals of forlorn hope." The gathering was entertained later by a thorough-going representative of Labour who, with a sincerity as impressive as his speech was vigorous, let it be known that if the Whitley Report was seriously intended to remove from his class the hardships from which they had suffered in the past, if the employers were sincere in their desires for true co-operation, if they were prepared to give the workers a fair share in the fruits of their labour, if they were going to prevent Labour being thrown on the scrap-heap when slump periods followed periods of plethoric production, the Whitley proposals were acceptable as a step in the right direction. But if those proposals were a means for perpetuating the old conditions under the label of industrial peace, he was a revolutionary of revolutionaries. The Industrial Reconstruction Council has been planned with the view to securing the co-operation of all parts of industry, and it was not inappropriate that this voice should be heard and this point of view be expressed, but our impression was that there was little enough of a spirit of conciliation to be found in it. To pooh-pooh Mr. Bevin's charges and claims on behalf of his class would be unwise, but it must not be imagined that all Labour runs along the revolutionary course any more than it can be supposed that all the workers will be persuaded to accept the moderate or reasonably evolutionary ideas of Mr. Roberts. Both speakers were applauded by the Guildhall audience, and probably between the two the ultimate course of industrial harmony will be found to lie. A point in the speech of Mr. Whitley which we think took the meeting by surprise, was the fact that he, as chairman of the committee, had received more inquiries respecting the report from men with the Forces, and from correspondents in other parts of the world, than from inquirers in this country. We suppose the explanation is to be found in our nearness to and occupation with actual hostilities or with war production. But, as we mentioned last week, practical interest in the Whitley report is now more general in industrial centres here than it was, and it is to be hoped that the propagandist efforts of the new Council will be the means of stimulating further interest in its proposals as a practical measure for providing against the times when angry passions may be far too easily stirred up, and for securing increased production of wealth without unfairness or friction.

NATIONAL ELECTRICITY SUPPLY.

By A POWER STATION ENGINEER.

The Interim Report issued by the Coal Conservation Sub-Committee to the Minister of Reconstruction is one of the most important which those engaged on the supply side of the electrical industry have had to consider in recent years. Nor can it fail to be of interest to all manufacturers throughout the country, as they are deeply concerned in the adoption of the most economical, cheap, and reliable system of power in order that they may be assisted to maintain the supremacy which this country has established in the production of manufactured articles for the markets of the world. During the last few years this supremacy has been challenged by more than one other country, and had not the war intervened it is possible that the business which this country has done so much to build up in the past would have gradually been transferred to competitors who, by the adoption of more modern methods of manufacture and salesmanship, have been slowly but surely encroaching upon what has often been considered our own special preserves.

In view of the criticism levelled against the composition of the Committee appointed by the Board of Trade to consider the future of electricity supply, it will be of little advantage to comment at any length on the personnel of the Coal Conservation Sub-Committee. Several members are undoubtedly well qualified to offer advice on the subject matter of the report. The case for coal conservation by means of increased adoption of electrical motor power is so strong in itself that no useful purpose appears to have been served in the report by deliberately going out of the way to belittle the work which local authorities have carried out in the past in connection with the development of electricity supply. Few will question the fact that many men, who have been at one time or another employed on the spadework of municipal development, would have been willing and able to assist in the consideration of this important problem, and whose presence on the Committee would have tended to restrict within reasonable limits the objectionable comments introduced, without in any way detracting from the principles which the report seeks to establish. The spirit underlying the whole report is one of undoubted hostility to the work at present carried on by local authorities. No public service has apparently been rendered by them in the past, nor should there be any place for them in the future. Only one, or possibly two, electricity supply concerns receive the Sub-Committee's blessing, *i.e.*, the group of companies on the North-East Coast and the power station of the Underground Railways at Lots Road. All the large municipal undertakings in the Kingdom with the exception of Glasgow, which by curious chance or intention is not mentioned, are condemned for one reason or another.

I have no intention of offering any criticism in regard to many of the matters dealt with; there is much that must receive the unstinted support of those who are in the best position to give an opinion as to the ways and means to be adopted in the future if electricity supply is to become what by rights it must and ought to be become, *i.e.*, "*The* key industry of the country," but that is no reason why one should not examine and comment upon some of the data on which the Committee apparently founds its conclusions. The report is undoubtedly strong in the main features of its findings, but the facts and figures on which many of the arguments are based are lamentably weak, or absolutely inaccurate, and I propose as shortly as I can to deal with some of these points.

The report is intended to deal with coal conservation only, and therefore proceeds to review the production of fuel by the collieries, and the subsequent disposal of it. Of a total get of 280 million tons in 1913, it is assumed that some 80 million tons represent the quantity used for the production of power, including railways, and this is the amount which may be affected by any general improvement in methods of consumption. After a somewhat lengthy discussion on the result to the country if industries would increase their production threefold, which is probably a matter more nearly concerning chambers of commerce than coal conservation, the report goes on to point out that this desirable end may easily be obtained if only the consumption of fuel per H.P.-hour is reduced by one-third. Reference is also made to the fact that during the last 25 years the coal consumption per H.P.-hour has been halved. The argument is developed to show that if all the power requirements were supplied electrically, and the present average consumption of 5 lb. fuel per H.P.-hour reduced to the equivalent consumption in the N.E. Coast power stations of 1.54 lb. per H.P.-hour, the total coal used at present for power purposes would be reduced by 56 million tons per annum. In order to obtain such a result, practically all existing power stations would be scrapped, and new super-stations, having from 100,000 to 250,000 KW. total capacity, and possessing generating sets of 30,000 to 50,000 KW. size, would be provided instead. It may be of interest to observe that although the North-East Coast is several times mentioned as being the one example of all that is right and proper in power-station practice, and the district supplied is undoubtedly one suitable for the development of electricity supply, those responsible for the design of the power stations have not yet found it advisable to install any individual generating sets of so large a size as 20,000 KW., not to mention 50,000 KW., although we are told that substantially all the power users of importance are already taking a supply from the companies. The question naturally arises why one of the members of the Committee who is largely responsible for the companies' operations has not adopted such large units of plant in one of the most concentrated industrial districts in the country, and yet advocates their use under less favourable conditions elsewhere. The claim in regard to supplying practically all of the industries in the North-East Coast is one which may well be challenged. Information is available which makes it more than doubtful whether this desirable end is yet obtained. Statistics would probably show that possibly only one-half, or even one-third, of the industries are being supplied from the public source, and if the district has already reached the saturation point electrically, there is a less brilliant future before the group of companies than appears to be contemplated by those associated with them.

It is generally recognised that one important point on which the successful development of an electrical supply undertaking may be judged is the units supplied per inhabitant of the area in which the supply is given. It offers a fair indication of "the initiative and resource of supply undertakings" on which so much stress is made in the report. Considered from this point of view, and taking the output of the North-East Coast companies as approximately 400 million units per annum, and the population on the basis of the 1911 census as 2,300,000, the units sold per head amount to about 174 per annum, and this *includes* a supply to railways, a class of supply which has been given by only one or two other supply undertakings in the country. There are already a number of local authorities in the Midlands supplying over 200 units per head of the population. In this connection also it is of interest to note from the published reports of the Lancashire and Cheshire Interconnection Committee that 26 undertakings, having a population of 2,376,000, supplied about 370 million units

during 1915-16, giving an average of 156 units per head of the population, *excluding* any supply for railway purposes. With this information available to guide them, it is difficult to understand why those responsible for drafting the report should state that the N.E. Coast companies supply three times as many units per head of the population as the Lancashire municipal undertakings, when such a statement is quite contrary to the facts.

(To be concluded.)

TELEPHONE EXCHANGE TRANSFERS AND THEIR ORGANISATION.

By F. G. C. BALDWIN, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

A transfer of subscribers' lines from an exchange in operation to another exchange usually coincides with a change in the system of working, and the replacement of old plant by more modern equipment; in this country the change most frequently met with is from magneto to central-battery working, with lamp signalling, and the methods of transfer are to some extent standardised. Transfers may be effected in three ways:—

(*a*) By transferring each line independently.
(*b*) By transferring the subscribers in groups.
(*c*) By transferring the whole of the lines at one operation.

Method (*c*) is the one usually adopted. The operation can be carried out expeditiously—the time taken being measured in seconds—and a period can be selected for the change when the least possible interruption to the service will ensue.

The subscribers' lines to be diverted must be dealt with in such a way as to render each line available for simultaneous connection to the new exchange when the circuit is severed from the old.

It will be necessary to install new cable plant from the new exchange to one or more suitable points where the lines affected may conveniently be tapped. These points may be situated as follows:—

(*a*) On the existing main underground routes.
(*b*) On the existing overhead lines.
(*c*) At the old exchange.

Existing conditions will to a large extent govern the line-plant arrangements to be adopted. In one of the simplest arrangements, new cable plant is provided between the new exchange and a point conveniently located on the existing cable system at which the whole of the lines are available. At this point Teed connections are made, thus linking the circuits to the main distributing frame of the new exchange.

Generally speaking, the tapping of the existing lines at the old exchange is undesirable, in consequence of the difficulty in avoiding interruptions of the working lines when cutting them out of the old premises after the transfer.

If the distance between the old and new exchanges is not excessive, it may be an economical proposition to divert the whole of the subscribers' lines into the new exchange, and thence to extend them temporarily to the old exchange. In this case the point at which the lines are Teed will be situated at the main distributing frame of the new exchange. This arrangement greatly simplifies the operations to be performed both at the transfer and afterwards; but the cost of provision of the circuits between the old and new exchanges, for the purpose of accommodating the subscribers' services until they are transferred, increases with the distance between the two exchanges, and unfortunately precludes the adoption of this method in every case.

This arrangement is a highly satisfactory one, and possesses the following important advantages:—

1. Elimination of external teeing points and consequent immunity of faults from that source.
2. Alterations to working circuits after transfer reduced to a minimum.
3. Severance of the old from the new plant automatically at transfer, and possibility of trouble arising from old plant left in circuit removed.
4. All Tees assembled at one perfectly safe point, affording facilities for their prompt removal.
5. Transfer operation conducted wholly in the apparatus room of new exchange.
6. Cost avoided of possible renewals to old plant to be afterwards discarded.

When the distance between the old and new exchanges is considerable and the circuit capacity of the line plant is necessarily limited, it may be advisable to have recourse to the method of transfer in groups. Several disadvantages are inseparable from this method.

Circumstances do not always permit of one arrangement only being employed, and in some cases two or more different arrangements are necessarily embodied in one scheme.

Fig. 1 shows that portion affected of the electrical circuit of one subscriber's line only, prepared for transfer from a magneto to a central-battery exchange.

The problem is to disconnect all the working lines from the old exchange and, simultaneously, to connect them for immediate service to the new exchange. Upon reference to the diagram it will be seen that if the heat coils at the old exchange are withdrawn, the exchange line will be disconnected there, and that if the insulating separators shown between the spring contacts of the cut-off relay situated at the new exchange be thereafter removed, the circuit will be at once thrown on to the new equipment, leaving the portion of the line between the Teeing point and the old exchange as a Tee upon the new circuit.

It is essential that the withdrawal of the separators from the cut-off relays should not be attempted until all the heat coils at the old exchange have been removed; failure in this respect will result in the circuit being closed through the indicator winding at the old exchange, and the calling lamp at the new switchboard actuated.

The means adopted for the extraction of the heat coils must be such that the whole are removed within the space of a few seconds. This can best be effected by means of two fairly strong tapes threaded behind the coils from top to bottom, one on each side of the strip, the two ends at top and bottom being bound together. If the bound extremities of the tape be held, one in each hand, a fairly smart and extended pull will cause all the heat coils in the strip to spring out of their clips. The possibility of faults being caused by displacement of springs or carbon blocks of arresters during withdrawal of the heat coils should be guarded against. If the protectors are of the earthing type, precautions are necessary to prevent the springs making earth when the heat coils are withdrawn. To avoid possibility of earth faults appearing during the period intervening between the transfer operation and the removal of the Tees, the whole of

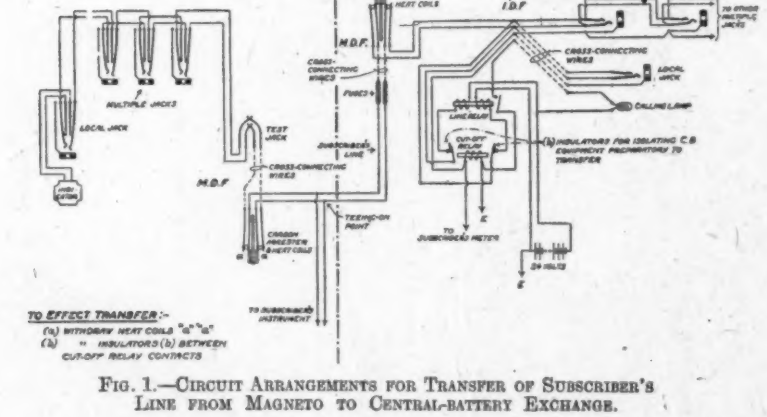

Fig. 1.—Circuit Arrangements for Transfer of Subscriber's Line from Magneto to Central-battery Exchange.

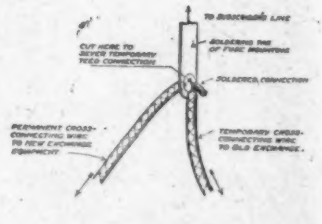
TO SUBSCRIBER'S LINE
CUT HERE TO DEVICE TEMPORARY TEED CONNECTION
SOLDERED CONNECTION
PERMANENT CROSS-CONNECTING WIRE TO NEW EXCHANGE EQUIPMENT
TEMPORARY CROSS-CONNECTING WIRE TO OLD EXCHANGE

Fig. 2.—Method of Making Temporary Tee Connections on Main Distributing Frame when all lines are diverted through New Exchange Prior to Transfer.

the carbon blocks and mica separators may be withdrawn, dusted, and replaced before the tapes are fixed.

To withdraw the fibre separators, a length of tape is passed successively through holes punched in the 10 separators of each relay mounting, and loops are provided at each end. The 10 separators may be withdrawn simultaneously by smartly drawing forward the tape whilst the loops at its extremities are held one in each hand.

Where the protectors are provided with additional springs in order to admit of the insertion of the test plug without first removing the heat coils, wooden insulating plugs may be inserted between the springs, so insulating the Teed lines from the new exchange plant. The withdrawal of these plugs will serve the same purpose as the withdrawal of the separators from the cut-off relays. A cord threaded through holes bored in the insulating plugs provides means for their simultaneous extraction. This method has the advantage that it avoids disturbance of the cut-off relays; also during the time the preparatory work is in hand, the heat coils may be kept in position from the outset, the new equipment being completely isolated by the wood wedges from the portion of the circuit external to the new exchange. If it be required to test any line with the new exchange equipment, the insulating plugs associated with the respective line may be removed (sufficient slack being left in the cord to admit of this being done) without removing the heat coils.

To provide testing and other facilities two break jacks are permanently included in the circuit of each junction line at the exchange. The jacks associated with the whole of these circuits entering an exchange are usually mounted together in a convenient position on the main distributing frame. From a convenient point on the line, a Tee is conveyed into the new exchange, where the line is insulated by the insertion of an insulating plug in one of the break jacks. The insertion of a similar plug into the jack at the existing exchange (or alternatively the withdrawal of the heat coils) and the withdrawal of the plug at the new exchange will have the effect of disconnecting the line from its existing exchange and throwing it on to the new.

The central-battery system demands that the line plant should be maintained with a relatively higher standard of insulation. Fleeting troubles, such as intermittent earths, contacts, and short-circuits of but little moment in the case of the magneto system must be eliminated. Therefore, when the change is from magneto to central battery it is advisable that the open line plant be overhauled, and such weaknesses removed.

In view of the peculiar troubles to which open lines associated with a central-battery system are likely to give rise, it is desirable that, so far as economically possible, the proportion of open line plant should be limited. Where the establishment of a central-battery system is justified, it is generally economical to arrange an underground system with distributing points from which the subscribers' services are completed by means of small distributing cables underground or short sections of open wire. In this way the mileage of open line is minimised.

The provision of Tee connections in association with the transfer of a large exchange is a matter of considerable importance. The manner in which the connections are first made and afterwards maintained has considerable influence upon the success with which a transfer is accomplished. An unsystematic arrangement of indifferently made Tees will un-

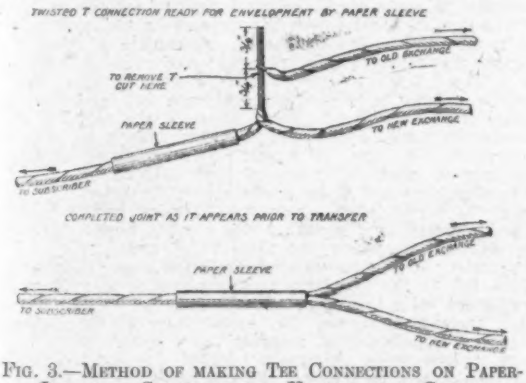

Fig. 3.—Method of making Tee Connections on Paper-Insulated Conductors in Underground Cables.

doubtedly be an endless source of trouble and anxiety to the engineer controlling the operations.

The small gauge wires on large cables (600 and 800 pairs) commonly used in modern telephone systems demand exceptional care in this connection, and it is highly desirable that, when once the Teed connections have been made, they should not be subjected to more disturbance than is absolutely unavoidable.

Fig. 3 illustrates a suitable form of Tee connection. The method permits the removal of the Tee without disturbing the through connection, and facilitates identification of the wire to be cut away.

Cast-iron cable boxes have been utilised in an attempt to facilitate hermetical closure of the cable and to provide ready means of access to the Tee connections. If such a measure be adopted, it is still desirable that the wires should be waxed and bound in order that they may satisfactorily withstand any handling to which they may be subjected. The box introduces limitations in the available space, and access to the wires is even more difficult than in the case of an open joint. No advantage is gained by their use except perhaps where the number of wires to be dealt with is limited.

A suitable method of forming Tee connections on open-wire lines is illustrated in fig. 4.

When the line arrangements for transfer admit of the Tees being made within the new exchange the serious difficulties introduced by external Teeing points are entirely removed. In some cases the Tee connections can conveniently be made at the main distributing frame of the new exchange, and a suitable method of forming the individual Tees is shown in fig. 2. This method is economical, admits of temporary disconnection of the Tee piece for testing purposes without dis-

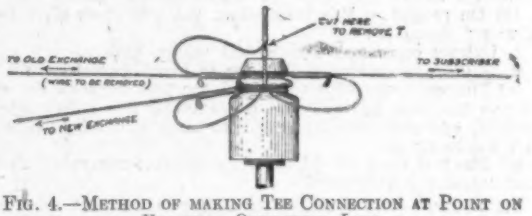

Fig. 4.—Method of making Tee Connection at Point on Existing Open-wire Line.

turbance of the permanent portion of the new circuit, and the Tees can be cut away rapidly without disturbing the through connection, which is left in its permanent state, no further attention being required, and no evidence of the Tee remaining.

The removal of a telephone exchange is often accompanied by a change from magneto to central battery, by which the introduction of automatic calling and clearing effects a quicker service. The displacement of the magneto generator and primary batteries at the subscriber's station renders a complete change of apparatus desirable, although not absolutely necessary.

Existing apparatus may be modified to permit of central-battery working until the modern central-battery apparatus is installed after the transfer. It will usually be economical and convenient to adopt this alternative in cases of subscribers' simple sets, and at stations with only one extension. In the case of installations with switchboards it is advisable to install new central-battery apparatus prior to the date of transfer, introducing the modifications necessary to provide for satisfactory working until the transfer has been made. The modifications required consist only of the provision of ringing facilities and of battery power for speaking purposes.

It is necessary to ensure that the receivers of all instruments are connected in such a way that the current received over the line from the central battery will augment rather than reduce the magnetism of the receiver magnet.

In ordinary cases the work to be carried out at the existing exchange prior to transfer will be mainly that of testing out the circuits in conjunction with instrument fitters, and making line changes with line foremen and jointers. Where a large number of subscribers' lines is concerned, the amount of testing to be done will be considerable, and it may be necessary to augment the existing testing equipment.

A suitable figure representing the minimum insulation permissible is 100,000 ohms for a central-battery exchange working at 40 volts.

Final tests of subscribers' lines are made at the test desk of the new exchange, and may occupy several days. Each circuit to be transferred is proved to ensure that the insulation and conductivity of the line are satisfactory, each subscriber is connected to the correct exchange equipment, the condenser is in circuit, and speaking is satisfactory. Each junction circuit to be transferred requires to be finally tested under actual working conditions between the new exchange and the distant exchange. The readings of subscribers' meters must be recorded immediately prior to the transfer.

After withdrawal of the fibre separators from the cut-off relays at the transfer, it is advisable to verify that the relay springs are making contact. A headgear receiver and a 2-microfarad condenser are connected in series, the free terminal of the condenser being connected to earth. A wire attached to the free terminal of the receiver is first tapped upon the lower spring of the cut-off relay, then against the upper. This should alternately charge and discharge the condenser, and a click should be heard in the receiver. The absence of a click denotes a fault.

On the evening of the day prior to that fixed for the transfer, rehearsal of the operation should be carried out under the direction of the officer responsible. Each man who is to take part should be interviewed at the position allotted to him by the officer controlling the transfer, in order to make certain that the duties are thoroughly understood.

The success of the operation will largely depend upon the

thoroughness with which the whole of the preliminary work has been arranged and carried out.

During the period immediately prior to the transfer, the circuits already connected in working condition to the new exchange should be tested out and proved in order.

At the pre-arranged time, the first portion of the junction circuits to be transferred, viz., those which have been scheduled for treatment in advance of the subscribers' lines, and which may approximate to about half the total number of junction circuits to be dealt with, should be diverted. This is accomplished by first inserting insulating plugs in the junction test-jacks of the circuits concerned at the old exchange, and immediately afterwards withdrawing the plugs from the corresponding jacks at the new exchange. These circuits may then be tested out, and any faults cleared before proceeding with the remainder of the lines.

At the appointed time the subscribers' lines and the remainder of the junction lines should be dealt with as rapidly as possible in the following manner:—

(*a*) The test clerk at new exchange requests over special telephone line the removal of heat coils at old exchange, and waits for advice that this has been accomplished.

(*b*) On receipt of this intimation, the test clerk gives pre-arranged signal to:—

1. Extract separators from cut-off relays, and
2. Withdraw remainder of plugs in junction test-jacks.

(*c*) The exchange supervisor and the test clerk at old exchange are then advised that the transfer has been accomplished, and the officer deputed to carry out relay tests is directed to proceed.

(*d*) The test clerk at old exchange informs supervisor there that transfer is completed.

Traffic conditions must be taken into account in selecting a day and time for the transfer operation. For several reasons it is desirable that a time should be chosen when the volume of traffic to be handled will be at a minimum, and that the same condition should obtain for as long a period as possible immediately following the transfer operation. This will ease the operating staff, give them an opportunity for the requisite testing, minimise interruptions to the service, and permit of a large proportion of the junction circuits being transferred in advance of the subscribers' lines; also opportunity will be afforded to remedy any defects which may arise, and to carry out any work, such as the removal of Tee connections, which requires to be done before busy traffic conditions are resumed.

In order to secure uniformity of attention to calls, it is necessary to distribute subscribers' circuits over the answering positions of the switchboard not in numerical order, but in relation to their traffic activities. Such distribution must be based upon actual observation of conditions obtaining for each subscriber's line, undertaken many weeks before the transfer is due, so that a scheme for the grouping of the subscribers' circuits may be completed by the time the intermediate frame is in readiness for cross-connecting.

A programme of instruction for the guidance of the operating staff concerned in the transfer should be drawn up, in order that no essential detail be overlooked.

Operators who are to be transferred from the existing to the new exchange should be familiarised with the working and local conditions of the new board in advance of the transfer.

After the transfer has been accomplished, the cutting away of Tees should not be commenced until the exchange staff has finished the tests of the whole of the transferred lines. Assuming that the exchange as a whole is then working satisfactorily, instructions may be given to cut away all Tees terminating on the springs of the protectors at the old main frame. The early removal of all Tees is advocated, as a possible source of faults will thereby be removed. In cutting away Tees in underground cables, each wire of a pair should be cut separately to avoid the momentary glow of the calling lamp which would otherwise be occasioned. When all the Tees at one point have been removed, the final jointing operations may be proceeded with, and when completed the joints should be plumbed in the ordinary way.

The prompt severance of all Tees on open-wire lines should be immediately followed by removal of the discarded portion of the circuit and the final restoration of the open-line plant where necessary.

To secure the most economical and efficient results in connection with a transfer of material dimensions, careful organisation of the whole of the work involved is obviously necessary.

From the point of view of economy, it is particularly essential that the various sections of work should be co-ordinated in such a manner as will preclude delay being caused to any section of the work by non-completion of any other section within the requisite time.

In order to reduce to a minimum the liability of interruption to which the service will necessarily be subjected, it is preferable that the various works associated with a transfer should be organised in such a way that no work which can possibly be done before the actual transfer be left until afterwards. Reasons for the adoption of this precaution are as follows:—

(*a*) There is a greater possibility of disturbance in carrying out work on the central-battery than with the magneto system.

(*b*) Workmen inexperienced in central-battery working, although accustomed to the magneto system, may not at first appreciate the greater care required.

(*c*) Operators transferred from a magneto to a central-battery switchboard do not at once obtain full proficiency, and should be caused as little trouble as possible from interference with working circuits.

An essential to successful transfer is the preparation of a complete programme embracing the whole of the work involved in the final preparations and in the actual transfer operation. This will guard against any essential operation or requirement being overlooked.

It is advisable that complete control of the transfer operation should be vested in one individual situated at one recognised point of vantage. The most suitable position will no doubt be at or in close proximity to the test clerk's desk.

Discussion in London.

Mr. Stubbs, in opening the discussion, said telephone men would be grateful for the author's valuable contribution to this important branch of the art. He was glad the author dismissed the idea of piecemeal transfers; even where two exchanges were to be transferred to one site it was still good practice that both should be transferred simultaneously. The transfer of the line plant by Teeing underground, &c., was also sound practice, where it could be done; the idea of Teeing lines at the old exchange was much more open to question, and did not appear to have any advantage over excluding the old exchange. The author did not appear to like the arrangement he referred to where plant was limited; but he (the speaker) thought it had considerable attractions, and it was well worth while to consider it. In the case of an ordinary subscriber, when transferring to an automatic exchange, it was impossible to leave the old instrument, and in this case they arranged for the bell condenser to be transferred while the old instrument was in use. The time programme showed how essential was care and experience in successful transfer work.

Mr. Moir said the paper brought out the great difference between the light and heavy sides of electrical engineering. The telephone engineer had not only to connect to his subscriber, but to carry his wires back to the exchange and connect through apparatus there, which accounted for the wealth of detail in the paper. A break could cause great trouble; as an instance of this, a fire in a subway which affected a few telephone cables necessitated the making of 19,000 new joints before the service was restored. As regarded the fibre separators, sometimes a small piece of fibre was left between the contacts, and he preferred a small wooden plug under the relay spring. It was necessary to use great care to secure favourable conditions for installing the equipment in a newly-built exchange. The Post Office authorities were not shy of transfers, as they had opened nine new exchanges in London with 62,000 subscribers between taking over the system and the war, and 19 cases for new exchanges were being investigated at the time war broke out.

Mr. E. S. Byng said transfers of exchanges were due mostly to lack of capacity; it was interesting to note that engineers now worked on a planning period of 15 years when estimating the building requirements for new telephone exchanges in order to avoid too frequent transfers. Obsolescence often occurred due to the introduction of new operating methods; in some cases the ideal position for the exchange altered due to development of one part of the area, and it might be economical to secure a more central position. The termination of tenure, or a fire, might also necessitate a transfer. The difficulties and risks of having external Teeing points could not be over-emphasised with multicircuit cables. Where it was possible to divert lines *viâ* the new exchange it was preferable, as it avoided external Tees, which were always unsatisfactory. If capacity was limited it might be necessary to interconnect several large cables in a manhole, and a plumbing flaw if the manhole were flooded might break down the whole telephone service. The method of making Tees illustrated by the author was a great improvement on the old method, where the three wires were made in the same twist. A telephone transfer was the most difficult work which fell to the telephone engineer, and the paper would be of great value to engineers in the future.

Mr. Bryant mentioned that in the case of the National Telephone transfers from magneto to common-battery, hardwood wedges were ultimately adopted for separating the relay contacts after trying various methods.

Mr. E. A. Laidlaw agreed that trouble was experienced with fibre and paper separators—numerous tests had shown that about six weeks after opening trouble ensued, and more faults were experienced than with wood plugs. The author's method of transfer was a good one, but costly; at a large centre, such as Manchester, it had been found that by making suitable arrangements for transfer with subscribers at the week-end, straight-through joints could be made for practically all of them; of 300 subscribers, it had been found that in only eight cases was it necessary to maintain the connection on Saturday afternoon.

Mr. Edmonds said there would be a very large amount of transfer work to be done immediately normal times came, and the paper would be particularly valuable then. Even telephone engineers might question whether the cost incurred

in carrying out the work set out in the paper was justified; the prime reason was to avoid interference with the public service, and it was worth a large capital expenditure to avoid depreciating the value of the telephone service in the eyes of the public. When the new exchange could be connected in parallel with the old one, it was possible to clear up faults before the transfer took place; experiences of this method at Victoria had been quite satisfactory. It was necessary for the traffic staff to closely co-operate with the engineering staff; the engineer must be sure that the service point of view was properly appreciated by his men. Faults in transfers could not be avoided, but the operation of the new exchange was often on a higher plane than that of the old one.

Mr. Anson said it was generally agreed that the wedge was the best method of separating relay contacts; the paper was valuable as showing the organisation necessary in transfer work.

Mr. Headley said the usual Post Office practice in connection with line plant was to use outside Tees and the grouped line method; he would like to know of instances where Teeing at the exchange was better. It was always an advantage to make use of existing plant, and this justified the grouped line scheme; two subscribers' lines were required, one to the old exchange and the other connecting the old and new exchanges; work had to be done in manholes outside, and it would be useful to have a diagram showing the method adopted. The grouped line scheme was the best one for large transfers, and it saved heavy expenditure in some cases.

The Author, in his reply, mentioned that his experience of the method of transfer with limited line plant was that the expense during the period of preparation was much in excess of the annual costs for some years of the additional cable plant required.

Discussion at Newcastle.

At a meeting of the Newcastle Local Section of the Institution of Electrical Engineers at Newcastle, on February 11th, Mr. F. G. C. Baldwin submitted his paper upon the subject of telephone exchange transfers.

Mr. J. R. M. Elliott, in opening the discussion, said the transfer of a telephone exchange was a subject that had received scant attention in literature; it was often an operation of the first magnitude, the cost in many instances running into many thousands. The conditions to be met in carrying out a transfer were varied and difficult. Mr. Baldwin had given just the information that was wanted. The development of the telephone service had been greatly retarded in consequence of the war, but once matters were in their normal state again, there would be a great programme of work, and a number of exchanges would be dealt with, for an attempt would be made to unify the systems of the National Co. and the Post Office, and that could only come about by the establishment of new exchanges, with common battery systems and automatic systems, instead of the magneto. As to Mr. Baldwin's three methods of carrying out a transfer, he thought that the most efficient and most economical system was that of transferring the whole of the subscribers at one operation; he had never heard of a transfer being made by an individual line at a time. The line rearrangement was a most important factor, but he thought no hard and fast rule should be laid down; it was a question of local conditions, and these varied too greatly to allow of a standard method being fixed. Where it could be done, he would strongly advise the adoption of the method proposed by Mr. Baldwin, to divert the whole of the subscribers' lines into the new exchange, and then temporarily to extend them to the old exchange. This, he thought, even if carried out at a slightly increased cost, would be more efficient than the other methods under consideration. He thought Mr. Baldwin's method of withdrawing the heat-coils was a barbarous one, and that they would be liable to get damaged. A better way would be to encircle each coil with a clip, and thread a tape through the clips, so that when the tapes were drawn the coils would come away. That raised the question whether momentary changes over were necessary. He did not think they were. If a definite time were given for each operation, so that the whole transfer could be spread over, say, five minutes—it might cause a little inconvenience to subscribers—he thought the freedom in operation would justify the delay. They had found a good time to make the change was two o'clock on a Saturday afternoon, for it gave a good amount of time before Monday morning. Passing to a consideration of the reference in the paper to insulation, the speaker said that the recommendation made by Mr. Baldwin of 100,000 ohms was not clear to him. He did not favour the fixing of a minimum; the insulation depended upon the weather, and he thought a great deal must be left to the testing officer himself. He raised the question as to the number of faults that would arise, were the exchange made ever so carefully. He thought these should not be more than 2 per cent.

Mr. Kitchen said the question of storage had not been mentioned by Mr. Baldwin, and he thought in commencing the work of exchange some sort of storage should be arranged for; if that were done, and there was a good storekeeper, the work would be greatly facilitated. From the time of estimating for an exchange to the actual time of removal, canvassing for subscribers should be discontinued. With regard to the testing of heat-coils, he suggested that the difficulty of getting back heat-coils, could be overcome by making a limit gauge. He differed from Mr. Elliott as to the insulation of the line. He thought it was very necessary that they should have a standard.

Mr. Peel, Mr. Bailey, and Mr. A. C. Hover also took part in the discussion, the last remarking that subscribers disliked their numbers changed in what appeared to be a very autocratic manner; their number was to some traders almost like a trade mark.

Mr. Baldwin, in the course of his reply to the points raised, said he had known a newly-opened exchange have fewer faults than the old one; by careful organisation they had managed to get the faults reduced to .2 to .5 per cent. As to what had been said as to the methods of transfer, a combination of all the methods he had named might be made, and there were also other methods. To attempt to make a standard method would be, he agreed, a mistake, they were governed so largely by local circumstances. The method of the lowest cost, all else being equal, was usually the method adopted. As to the suggestion that he treated the heat-coils in a barbarous manner, and Mr. Elliott's suggestion that clips should be used, they must consider that heat-coils were themselves inexpensive things, and whatever method they might adopt must not cost more than the heat-coils that were damaged or broken. He was no advocate of a momentary change-over. With regard to what had been said as to insulation, he thought there should be a minimum. If a circuit would work on a set insulation there was no reason why money should be spent on increasing the insulation beyond that figure.

ORGANISED EFFORT.

By A. L. STANTON, A.M.I.E.E.

(*Abstract of an address delivered before the* Swansea and District Institute of Engineers.)

A little thought upon the conditions immediately preceding the war will very clearly indicate that "limitations" were, more or less, the order of the day. The history of industrial disputes, the failure to realise the advantages to be derived from the adoption of co-operative principles as against wasteful competition in industrial enterprise, and a disinclination to overcome the obstacles tending to hold up the expenditure of wealth on the development of industries along the most modern lines—all provide striking evidence of "limitations" which form a serious drag upon the wheel of progress. The conceptions of life immediately ahead can never again be as they were. We are passing through an era of destruction, but after its destructive power has exhausted itself, the ever-present constructive force at work again demonstrates its absolute supremacy in the realm of reality, and movement after movement for the attainment of a greater freedom from limitation follows.

The State should recognise the advantages to be gained from equipping its citizens, so that all may successfully engage in that primary function of physical life—the earning of a living, free from the nightmare of poverty. "Patriotism" used to be more or less associated with Empire Days, national history days, and Navy League annuals, but the militant spirit is only one aspect of the *full* spirit of true patriotism, which makes a demand upon the everyday life of the individual, during both days of prosperity and those of stress and trial.

Too often do we all set limits to ourselves. As one result of it, the average trade unionist is not so interested in the value of the work he performs from a national point of view as he is in the securing of personal advantages from the doing of it. A similar spirit also too often animates the employer. If it were otherwise, then discord and distrust between Labour and Capital could not exist. Moreover, a belief in the power of *destructive* criticism prevails, which is, in itself, productive of much discord. A real need exists for *constructive* criticism, and this can only be developed through cultivating the power for right and independent thought among all concerned. A primary duty to-day, therefore, is to give heed to the necessity for developing the constructive sense in its full power.

This war constitutes, more than any other, a truer vision of organised effort between nations. Organised effort has become the predominant thought, for war under present-day conditions has become a national industry. All errors due to proved inefficiency are invariably associated with waste of some kind. Germany recognised the value of this principle long ago, with the result that when the call came, every individual had a pre-arranged definite part in the organised effort which the conditions were deemed to demand; all had their relative positions delineated on the scheme of operations, so as to provide for a minimum of national waste. Its results are self-evident in the prolonged resistance they have been able to put up, against the vast resources arrayed against them, and in the rapidity with which they have changed their tactics, or methods, when any principle in operation proved defective.

It is only by making an analysis of the causes which enabled Germany in a few decades to rise from comparative obscurity to a dominant position in the industrial life of the

world, that one is enabled to gain some idea of what "organised effort" means. Every student of economic history knows that in Germany it commenced with the child, and continued throughout the life of the individual. Collective efficiency was the watchword; individuality, as we know it, was never fostered. Moreover, just as every boy in China used to be taught geography from the point of view that China was the centre of the commercial world, so was the young German led to think that the main elements of modern science originated with his people. We ourselves have very largely fostered the belief in the superiority of other industrial nations by the publication of sensational articles belittling our own methods, and have put a premium upon efficiency by stifling originality and initiative. If the maintenance of our industrial life is to be held secure, "incentive to achievement" free of limitation for the really efficient worker must be recognised as a fundamental demand of the new conditions which the conclusion of the war will bring about.

Is not a heavy penalty being exacted for its past non-recognition even now? Obviously the German system had grave defects, but withal, it did produce huge numbers of highly-trained men in the technical and industrial sense who willingly worked for comparatively low wages, by reason of the incentive given through research work and industrial prizes of high value. They were thus able to make and sell many commodities at a lower price than their competitors, and if to the features outlined are added a more positive control of labour than was possible elsewhere, with the co-operation of the Government, and that in an autocratic sense, for the pushing of exportation and transportation, no surprise can be expressed upon learning that such a system produced results. Efficiency undoubtedly begets confidence, and that particular quality associated with the German system developed it in bulk.

The prime attraction of the German-made article was its cheapness, coupled with the fact that the German manufacturer never forced standardised articles upon his customers. On the contrary, he was always willing to make any article according to the demand, and moreover, gave free advice on it. These are all points which count, and it is self-evident that business organisation acting in an "organised effort" with technical skill, can effect progressive enterprise to an extent not possible otherwise.

All industrial activity depends for its operation upon a continuous supply of energy, and few will contradict the assertion that electricity is the most convenient and flexible form whereby energy can be transmitted, distributed, and utilised; but at the present time its generation and distribution is conducted upon anything but efficient lines. A proper recognition of this has only been brought about by the war limiting the output of fuel. The value of "organised effort" in this field of utilitarian activity will be self-evident if the enormous saving and extension of service rightly to be anticipated as a result of putting into operation well-designed schemes of linking-up areas are realised. The question of main-line railway electrification is another field which the near future should bring right to the forefront. Anyone interested in either electrical or railway development will be acquainted with the serious limitations imposed by legislation of an obstructive nature. Is it too much to hope that one can look forward to the time when some legislative control of a constructive nature will be exercised over matters relating to the standardisation, development, and purchasing power of natural resources? It may not be amiss to point out yet another aspect of national waste, wherein "organised effort" can assist utilitarian ends. It is well known that the British iron and steelmaster has in the past shown reluctance to give the by-product recovery coke-oven a chance to demonstrate both its saving power and its earning capabilities when compared with the bee-hive oven. Fully three-fourths of the coke produced here is made by the bee-hive oven process, which undoubtedly is one of the most wasteful industrial processes in operation. The only saleable product of the bee-hive oven is coke, whereas the by-product recovery plant type produces, in addition to coke, power gas, benzol, tar, and sulphate of ammonia. Furthermore, as the acid required for the conversion of the ammonia by-product into nitrate now admits of being made by electric power, on sound commercial lines, at the point where the by-product itself is collected, the increased value of this most essential element of life under the present conditions must of necessity draw attention to continual advances being made along lines which break down all existing limitations. Looking still further ahead, it is not difficult to visualise the coming into vogue of entirely new ideas which, with the possibilities of a national electric supply, will, so far as furnace work is concerned, admit of doing away even with the necessity for coke at all; but it is of interest to know that, prior to the war, no German ironmaster had a bee-hive oven plant in operation, either for blast-furnace or reduction work.

I am convinced that there is coming a time when the barriers which national lethargy has built up must crumble away. Those who follow up the advances made in the spheres of electrochemical and electrothermic processes will need no reminder of the revolution many processes of present-day production must undergo if our industries are to hold their own, and "organised effort" has a great opportunity here. The chief thing which made Germany a most formidable foe lay in the recognition given to "thoroughness of efficiency" in industry, and mass intelligence control. I venture to think that one of the greatest compensations likely to result from the struggle will be a world-wide recognition of this principle, *not, however, as the German believed in it*, but as applied to constructive and regenerative processes of thought. Because of it, the aim of education must inevitably become more utilitarian than ever before, a greater attention must also be paid to vocational training, and a changed view on the part of a large section of the general public regarding the mechanical professions and allied trades must come about. The new conditions imposed upon commercial life will demand it, and the need for better trained men will be greater than ever. True co-operation and right organisation but need to be brought to bear upon our daily lives in order to obtain the maximum yield from the service rendered.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The 12½ per cent. Award and Clerical Staffs.

Having read in your last issue the letter from "Chief Clerk," may I also through your esteemed columns express my hearty support of his views, which I am sure are shared by the clerical sections of the technical staffs of all the supply companies and Borough Councils throughout the kingdom. It seems rather a pity that the Award was not framed in such a way as would leave no doubt that clerks, who, in the majority of cases, are relied on quite as much as the actual electrical assistants, were intended to participate in this bonus. Apparently at the present moment, the companies or public bodies are left with the option of either including or excluding the clerical side of the technical staff according to their own construction of the terms of the "Award," and, therefore, it is not surprising that the vast majority have adopted the latter, especially as the clerical profession are not likely to invoke the assistance of a Union to voice their demands, which is the reverse of the case if the manual workers in connection with electric supply work had been left out.

Seeing that this bonus is, I take it, to help pay the increased cost of living, there is, in my opinion, no good reason why clerks (who are also privileged to pay the present prices) should be left outside its scope.

I therefore hope that some official ruling will be given, in order that we clerks who are engaged on technical, statistical, and other work in connection with the generation or distribution of electricity for supply to private and public users, including munition factories, may be included in the Award in question.

I trust that you will use your good efforts on our behalf on this point, and, by doing so, you will earn the deep appreciation of a body of workers who have certainly been as hard hit in the matter of living expenses, &c., as any other section of the community, without having the opportunities to obtain redress such as are open to the manual workers in the electrical line.

One last point: as apparently men who act as storekeepers in generating or distributing stations benefit by the 12½ per cent. Award, how is it that men who act as clerks and storekeepers (but happen to be rated as clerks on the wages sheets, &c.) do not participate?

Another Chief Clerk.

February 15th, 1918.

British Water Power.

Regarding the article on British water power, in your issue of February 8th, while expressing my appreciation of the same, I would like to point out some omissions. The author has given England, Wales, and Ireland but scant attention; the impression is given that Chester possesses the largest water-power plant outside Scotland. This is not so, as the Aluminium Corporation have a 7,000-H.P. plant near Colwyn Bay, North Wales, and plenty of water is available for any extensions. The North Wales Power Co. have a 5,000-H.P. plant near Llanberis, the head in each case being about 1,000 ft.

Kiwi.

[Our abstract was necessarily very brief, and we do not think the author intended to convey the above impression; his point with regard to Chester was the successful utilisation of a low head on a river.—EDS. ELEC. REV.]

Examinations in "Electrical Installation Work."

As one of those whose age ranges between 15 and 60 years, as referred to by Mr. W. Ellerd-Styles in his letter of the 11th inst., I can only say that it is no fault whatsoever either of the South-Western Polytechnic or of the instructors if full advantage is not taken of the opportunities offered to the students, for I am convinced, speaking from practical experience, that these technical institutes are a real boon to anyone who wishes to learn, no matter what the subject may be. The only fault, so to speak, that one has to find with the institute is that it is not better known, and it is a matter of regret that the governing body do not take steps to this end.

What the percentage may be to which Messrs. Lundberg refer is a matter, of course, of which I have no opportnuity of judging, but perhaps many of the students, especially some of the seniors, may not have joined the classes with a view to going up for examination.

Such are the advantages that these technical institutes offer, that I am convinced that it would be a good thing for the country and for the empire if every boy or man under a certain age working in a factory should be compelled to spend so many hours a week of his working time at one of the institutions, as thereby he would be able to gain a technical as well as a practical knowledge of his work, and that it should also be a regulation that every workman should pass his examination, and thereby be able to produce a certificate of his skill.

K. Warner.

London, S.W., *February 19th*, 1918.

Switchboard Passageways and "High Visibility."

I have a suggestion to hand on to those engineers who are concerned with the maintenance of main switchboards.

In a great number of cases the backs of the panels have a dull surface, nearly black in colour; with this as a background, efficient inspection and maintenance is rendered difficult to a degree. This state of things is common, but can be readily improved, at a small cost, by coating the exposed surface on the back of the panels with white enamel, the wall forming the other side of the passageway being treated in a similar manner if necessary.

There is at least one make of enamel which has a fine, hard gloss, and remains white for a long period; needless to say, the brushes used for the work should be non-metallic.

The improvement the above treatment effects is considerable; the nuts, lugs, &c., show up clearly and sharply against the white background, work is done better and more quickly, less artificial lighting is required, and the risk of accidents is minimised.

Chas. Cuthbertson.

Stoke-on-Trent, *February 18th*, 1918.

LEGAL.

Sulley v. Withers.

In the Lord Mayor's Court, on February 11th, before the Recorder (Sir Forrest Fulton, K.C.) and a jury, plaintiff, an auctioneer and surveyor, 46, Cannon Street, E.C., sued the defendant, Mr. Stephen Withers, East Sheen, to recover £46 10s. upon a dishonoured cheque given by the defendant for the purchase of certain lots of electric pocket-lamp batteries bought by him at an auction sale held by the plaintiff on November 26th last, at premises situate at 26, Tottenham Square, Tottenham Road, Dalston. The defendant raised a counterclaim for damages, and alleged that the plaintiff had been guilty of fraud, and that he had carried on a fraudulent system of business.

Mr. Morle, for the plaintiff, said that the facts of the case were quite simple, but the defendant had thought fit to place on record a grave and serious charge against the plaintiff. In the latter part of November last year the plaintiff, in the ordinary course of his business, was instructed by Mr. Grizard, of Tottenham Square, Tottenham Road, Dalston, to offer for sale by public auction at his premises an assortment of articles that had been acquired in the ordinary course of business. Mr. Grizard was a buyer of odd and damaged stock. Plaintiff prepared a catalogue of the things to be sold, the sale to take place on November 26th. A copy of the catalogue reached the defendant some days before the sale. Amongst the articles for sale were 27,000 pocket-lamp batteries. Prior to the sale the goods were on view on Saturday, November 24th, from 10 a.m. to 3 p.m., and also on the morning of the sale, which was to commence at 11 o'clock. The auctioneer gave the plainest and fullest warning that intending purchasers must buy at their own risk. In the conditions of sale appearing in the catalogue, plaintiff also gave warning that intending purchasers must rely upon their own judgment in connection with their purchases. The catalogue bore the words: "A salvage sale of salvage goods." The defendant had examined the goods, and had said, in connection with the batteries, that although there were some "duds" amongst them, he should make a bid for them. The defendant attended the sale, the lots for which the cheque in question was given being knocked down to him some time in the afternoon of the day of sale. He bought three lots of 1,000 each at 1s. per 100. The batteries came from America, and instead of getting on the market through the usual channels, they received damage on the way and got into a salvage sale. The defendant did not clear the goods at once. Several days passed; no doubt, he (counsel) suggested, defendant was trying to find a purchaser for the goods. On November 30th defendant gave his cheque and proceeded to remove the goods. At the time of the removal, defendant had a conversation which showed he knew perfectly well he was buying a speculative assortment of goods. Four days later defendant complained that only a third of the goods were really effective batteries, and he refused to accept them. His cheque was returned dishonoured, being marked "R.D." That happened on December 4th, and on December 7th the present proceedings were brought. The defendant now set up that he ought not to be called upon to pay for the goods, because he was induced to give the cheque by the plantiff's fraud and by the fraudulent system of business the plaintiff carried on. That was the gravest allegation to bring against a man like the plaintiff, who had practised in the City of London for a number of years. The grounds for saying that the plaintiff was fraudulent were that the goods sold were not as shown, that the upper layers of goods contained 75 per cent. of effective and 25 per cent. worthless batteries, and that the underneath layers consisted almost exclusively of worthless batteries, which proved the goods were not as shown. Neither the plaintiff, counsel said, nor anybody in his employ, had anything to do with the packing of the cases, and they were sold in the same way as received. The defendant had alleged that the plaintiff's conditions of sale were obviously prepared to enable him to carry on a fraudulent system of business. The plaintiff's conditions of sale were similar to those to be found in all auction sale catalogues, and were framed to protect the auctioneer as much as possible.

After hearing the evidence, the jury sent an intimation to the Recorder to the following effect:—"My Lord, the jury are agreed that an auctioneer should not be held responsible for the condition of goods he sells. The defendant should pay for the goods, apologise and withdraw the charges he made."

Mr. Merlin, for the defendant, said he had evidence to put before the Court at the proper time, but he refused to do so before the present jury. It was useless, under the circumstances, to go on with the case, and he made an application for a new trial.

The Recorder said in that case he would take the verdict of the jury, which was for the plaintiff for the amount claimed, and for the plaintiff on the counterclaim.

An order was made that the costs on the counterclaim should be taxed on the scale above £50. A stay of execution was granted the defendant for seven days, to enable him to give notice of his intention to move for a new trial.

Alleged Electric Cable Detention.

In the High Court of Ireland, Dublin, Mr. Justice Gordon granted an application on behalf of the defendant for discovery of documents in an action by Messrs. Richard Farrell, Ltd., merchants, Goughal, against Mr. John Landy, Rathfarnham, Dublin, for the return of a quantity of electric cable, or for its value (£143), and damages for its detention. Counsel said the point at issue between the parties was whether the cable was sold to the defendant by an agent of the plaintiffs.

WAR ITEMS.

More from "Over There."—A Naval Officer, writing from the Orkneys, says:—"I wish to take this opportunity of again thanking you for sending me the Electrical Review so regularly. It is very much appreciated by us all, and serves as a connecting link between the present life and the profession we have temporarily left."

A technical correspondent with the R.F.C. writes thanking us for the E.R., which reaches him regularly every Monday. He adds:—"There are now 20 of us, all electrical men, billeted in one hut, and the pleasure that the arrival of the Review gives us cannot be exaggerated. I am in Blighty on leave. . . . I only hope that this will be the last leave I shall get, and that before the next one is due Peace will be proclaimed."

Exports to China.—The *London Gazette* contains a further list of persons and bodies in China to whom exports may be consigned.

Trading with the Enemy.—The *London Gazette* for February 15th contains a further list of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Chile, Costa Rica, Greece, Guatemala, Hayti and Dominican Republics, Honduras, Morocco, Netherlands, Netherland East Indies, Nicaragua, Norway, Panama, Peru, Portuguese East Africa, Salvador, Spain, Venezuela.

Exemption Applications.—At Ashton-under-Lyne, last week, the application for exemption made by J. N. Bardsley (31, grade 3), electrician, Waterloo, was not assented to after April 15th.

Stratford-on-Avon Rural Tribunal heard a review of the case of Arthur Baldwin (40, B 1), electric light attendant for Mr. J. Fielden, of Kineton House. On November 16th last the case was put back for the military to provide a substitute, and one has not yet been found. Mr. Fielden said that the man provided the current for the war hospital. Major Neilson said that the question of substitution was now out of his hands and rested with the employer. He suggested that the man's place should be filled by a man of lower category. Two months were granted to see if a substitute can be obtained.

At Torquay, an appeal was made by Geo. Davis (33), tramway storekeeper, who was said to be absolutely unfit for military service owing to heart affection. The appeal was respited for a further medical examination.

At Truro, G. H. Lear (24, Grade 2), electrical engineer, applied to go before the Central Medical Board for re-examination. He said that the local Medical Board took no notice of his doctor's certificate. The Tribunal granted the request, and gave exemption until March 1st.

The East Sussex Appeal Court has disallowed a military appeal against exemption until March 14th granted to a Brighton electrician aged 30.

At Hastings, Mr. V. W. Edwards, manager of the tramways, applied for leave to renew an appeal for an employé named

Tapsell, whose category had been lowered from A 1 to Grade 2. The chairman said that the distinction was a small one, and leave would be refused. A motorman was, on the recommendation of the military, allowed three months' conditional exemption.

At Cambridge, the National Service Representative appealed against exemption granted to W. O. Pilgrim (40, Grade 1), electrician, with Messrs. Bailey, Grundy & Barrett, electrical engineers. It was stated that the man was putting in practically his whole time at the gas works, where work of great importance was done by electricity, and unless the firm had a competent electrician it would be a very serious matter for the town, the military hospitals, and the railway. Pilgrim was directed to join up by May 1st.

At Wolverhampton, six employés were appealed for by the manager of the Corporation tramways. Two, who are Reservists, were given conditional exemption; the others were directed to go before the National Service Medical Board.

At Cirencester, Major R. A. Scott, of Hatherop, appealed for the retention of F. J. Turrill (37), electrician. He served seven years in the Navy, but had been three times rejected for the Army since the outbreak of war. The Tribunal ordered a medical examination.

On appeal of the manager of the Corporation tramways, Mr. Lambert, the Maidstone Tribunal has granted six months' exemption to A. E. Chittenden (33, B 2), spare driver, and three months to F. Rose (37, Grade 3), a regular driver.

ELECTRIC POWER SUPPLY.

We have received from Mr. H. Faraday Proctor, hon. secretary of the Incorporated Municipal Electrical Association, a copy of the following statement, which has been agreed by the Council of the I.M.E.A. in conjunction with the Association of Municipal Corporations. The statement has been forwarded to the Secretary of the Board of Trade Electric Power Supply Committee, with the comment that while it represents the views of the Council, the membership of the Association includes many of the smaller undertakings, which may not be in agreement with the whole of the views set forth:—

Electric Power Supply.—Statement.

1. To ensure that there shall be an adequate and economical supply of electric power it is necessary that the areas of supply, instead of being local government areas, should be areas specially delimited as areas suitable for electric supply, having regard to demand and facilities for obtaining suitable sites for generating stations. The application of this principle must depend upon the local circumstances, including the position of existing supplying and distributing authorities, and the facilities possessed by them and their liabilities and obligations.

2. Different considerations will apply to generation and distribution, and these need not in all cases be in the same hands. Generation should be on a large scale, and extend over a considerable area. Distribution which includes dealing with individual consumers may conveniently be organised in smaller areas.

3. The new areas, both for generation and distribution, should be continuous, and will in many cases include within their limits places which at present are without a supply, either because no powers exist there, or because existing powers have not been exercised.

4. Having regard to the paramount requirements of an adequate and economical supply, the best use possible should be made of existing systems of generation, transmission, and distribution, and also of the local knowledge obtained by established undertakings. The suggestions which follow are put forward as alternatives to be moulded in each case by the Central Authority, according to the circumstances.

5. In many cases a joint board might be established for the generation of all the energy required in a large area, and for the transmission of such energy by means of trunk mains, leaving the distribution to be effected locally. This board should comprise representatives of all the local authorities supplying electricity within the area in question, and all the existing generating plant and transmission mains would be transferred to it. It would have power to raise capital, either by means of a precept on the constituent authorities or by borrowing on the credit of its undertaking and of the rates levied by those authorities.

The distribution areas would not necessarily be identical with existing supply areas, as ground might have to be covered which is not now within the area of any supply authority. It is suggested that existing supply authorities might undertake the distribution within larger areas than their present ones.

6. The following alternatives, which have been adopted with excellent results in the supply of water and gas, may be found solutions to the problem in certain cases:—

(*a*) Where there is a large undertaking which is detached or isolated from other large undertakings, with a number of small undertakings in the neighbourhood possessing their own separate sources of supply, the object would be attained by facilitating an extension of the large area for the purpose of the generation and transmission of energy, so as to include the small areas, and by transferring to the large undertakings upon fair terms the generation and transmission systems of the small undertakings. The distribution, including the areas now without supply, would be carried out locally either by the existing authorities or by the large authority. The remarks as to distribution areas in paragraph 5 would also apply in this case.

(*b*) A new authority might be established similar to that outlined in paragraph 5 to carry out the generation, transmission, and distribution of electrical energy throughout a large area, acquiring on fair terms all the existing interests within such areas.

7. When the whole or a portion of an existing undertaking is transferred to a larger authority, suitable provision would be made in regard to the rights and obligations of existing undertakings, the capital commitments and the responsibilities towards any officers whose status or remuneration would be affected.

8. In our opinion it would be a fatal mistake to depart from the principle upon which Parliament has acted, with very few exceptions, for many years past, that undertakings of this description, which involve a monopoly, and upon which the prosperity of the people depends so largely, should be entirely in the hands of the public authorities.

9. These proposals would be complicated in districts which are now partly supplied by companies. With the exception, however, of London, and of an area on the North-East Coast of England, there are very few places where undertakings of any size are vested in companies, and probably where there are such undertakings the best course would be for the joint board or the extended municipal undertaking referred to in paragraph 5 to acquire them upon fair and equitable terms.

10. The questions of London and the North-East Coast require special consideration, and the foregoing observations are not intended to apply to them.

11. We have also considered the question of a Central Government Authority, and, whatever may be the ultimate form or constitution of the authority, we think that, in view of the many important decisions to be made in the immediate future, and the new duties and powers which will fall to be administered, it should be strong on the technical and inspectorial sides. We consider also that whatever central authority is entrusted with such work, it must be responsible to Parliament.

Standing Conference of Electricity Supply Associations.

Mr. Proctor also notifies us of the formation of the conference above-named, which has been established so that there may be one single body representative of the whole of the electricity supply undertakings throughout the Kingdom, whether municipal or company owned. The conference is constituted as follows:—

The Incorporated Municipal Electrical Association, representing 196 municipalities.

The Conference of Chief Officials of London Electric Supply Companies, representing 13 companies in London.

The Incorporated Association of Electric Power Companies, representing 11 power companies in the provinces.

The Provincial Electric Supply Committee of the United Kingdom, representing provincial companies.

The conference will deal with matters relating to conditions of employment, the rates of remuneration of staff and employés, and other matters of general concern.

BUSINESS NOTES.

Combination Rumours.—According to several newspapers, negotiations are reported to be in progress for an important combination of big shipbuilding, armour plate, and iron and steel interests. Companies named are Vickers, Beardmores, and several concerns on the North-East Coast and in the Midlands. It is expected that the capital will amount to a huge figure, and that the combine will have far-reaching effects.

Sweden.—The Swedish General Electric Co., of Stockholm, has recently acquired control of the business of the Swedish Ljungstrom Turbine Works Co., of Finspong, having purchased the majority of the shares of the undertaking.

Depreciation of Machinery.—In reply to a question asked in the House of Commons by Mr. George Terrell, Mr. Bonar Law said:—The income-tax allowances in respect of the depreciation of machinery and plant fall to be determined not by the Commissioners of Inland Revenue but by the respective bodies of Income-Tax Commissioners upon whom it devolves to allow such deductions as they may think just and reasonable.

Liquidations.—Vaughan Engineering Works, Ltd., 22, Cross Street, Islington.—First meetings of creditors and contributories, March 1st, at 38, Carey Street, W.C. 2.

Balcke & Co., Ltd., 27, Clement's Lane, London, E.C.—On the petition of the Board of Trade for the winding up of this company under the Trading with the Enemy Act, Mr. Justice Younger in the Chancery Division on Tuesday said it was desirable that there should be a winding-up order. He made the usual order allowing the costs of the company.

Plant for Sale.—Swindon Corporation electricity and tramways department has for disposal one 300-kw. generating set, consisting of a Davey-Paxman triple-expansion engine coupled to two 150-kw. D.C. dynamos.

Basingstoke Corporation electricity department has a small electrical plant for disposal. Particulars are given in our advertisement pages to-day.

Catalogues and Lists.—Messrs. E. Bennis & Co., Ltd., 28, Victoria Street, London, S.W. 1.—Thirty-two-page catalogue containing very full and illustrated descriptive and other matter relating to their patent coking stokers. The latest improvements are summarised, and notes are given on the methods of operation, also particulars of test results. Copies of the catalogue will be forwarded on application to the firm.

Messrs. British Utilities, Ltd., 148, South Park Road, Wimbledon, S.W. 19.—Leaflet giving prices of batteries for pocket lamp, bell, and other service.

Messrs. Higgs Bros., Summer Hill Street, Birmingham.—Stock-list of standard shunt-wound ventilated motors. Such a list is to be issued monthly.

The Key Engineering Co., Ltd., of Trafford Park, has issued a vest-pocket celluloid calendar for 1918.

"Scholey's Magazine" for January contains interesting opening notes on amalgamations in industry, the status of the engineer, and other subjects. Descriptions are given of the "Kutmor" electric drills and grinders, the "Premier" electric suction cleaner for factory service, and other Scholey manufactures. The objects of the Industrial League are stated, and its progress is reviewed.

Messrs. Ward & Goldstone, Salford.—Circular giving illustrations of a range of assembled cables and cords with various terminal ends, manufactured by them for all purposes.

Bankruptcy Proceedings.—William T. Smith, electrical and mechanical engineer, Bolton.—The public examination was fixed for February 13th, at the Court House, Bolton, but was adjourned. The Official Receiver (Mr. Gibson) said debtor had submitted a proposal for a composition, and the public examination could not be concluded until the meeting of creditors had been held and closed. The meeting of creditors had been adjourned for a month, so the examination must also be adjourned.

George Edward Hipkins, electrical engineer, 48, Wolverhampton Street, Dudley.—Last day for receipt for proofs for dividend, March 5th. Trustee, A. M. Fairbairn, 1, Priory Street, Dudley. An application was made at the Court House, Dudley, recently, for the discharge from bankruptcy of the above-named debtor. It appeared that the ranking liabilities were £510, and the assets amounted to £151, and a first and final dividend of 3s. 3½d. in the £ had been paid. The debtor commenced as an electrical engineer in January, 1913, and in September, 1913, went into partnership with another in another business at Dudley Port. The Official Receiver reported that the debtor's assets were not equal to 10s. in the £ on the amount of his unsecured liabilities, that he had omitted to keep such books of account as were usual and proper in the business, and that the debtor had brought about, or contributed to his failure, by rash and hazardous speculation and neglect of his business affairs. The Official Receiver stated that since the report had been filed debtor's friends had offered to pay £100 on his behalf, which would make up the dividend to 10s. in the £. Debtor had served in the Army for over two years, and had been wounded. His Honour granted the application for discharge, and judgment was entered against the debtor for £100.

An Electrical Amalgamation.—The following statement appeared in the *Times* "City" column on February 15th :—

"We learn that the rumours which have been in circulation regarding the acquisition by the General Electric Co., Ltd., of Fraser & Chalmers, Ltd., are well founded. Negotiations have been in progress with the object of amalgamating the two businesses, but they have not, we understand, yet reached a stage at which an official statement can be made. Such a fusion would no doubt enlarge the scope of operations of the General Electric Co. and its associated enterprises, and might indeed form an important link in the scheme for placing the electrical industry in this country on a footing which would enable it to compete advantageously with foreign manufacturers after the war. Fraser & Chalmers are the well-known manufacturers of mining and other machinery, and have an established connection with the principal mining fields. The company was originally formed to acquire the control of an American company, but in 1901 the American business was disposed of."

We may state that what has happened is this :—The General Electric Co., Ltd., has purchased the works and entire establishment of Fraser & Chalmers, Ltd., at Erith, and will add to its already wide range of electrical engineering manufactures turbines, coal-conveying and gas-cleaning apparatus, and steam boilers. The whole of the Fraser & Chalmers business thus becomes transferred to the General Electric, with the exception of the gold-mining equipment, which will be continued by Messrs. F. & C. A further interesting development is the purchase by the G.E.C. of a controlling interest in the well-known electricity meter manufacturing firm of Chamberlain & Hookham, Ltd. The latter firm will operate under the same name as hitherto, and will be conducted as a separate company.

Trade Announcements.—The Century Electric Co. have removed from No. 14 to No. 28, Brown Street, Manchester.

Messrs. Ferranti, Ltd., are to-day vacating their Kingsway offices and taking up temporary quarters at 57, St. John's Square, Clerkenwell Road, E.C. 1. New telephone number : Holborn 1018.

Book Notices.—*The Silewani-Ghat Hydroelectric Power Project in the Chhindwara District.* By E. Batchelor, I.C.S. Allahabad : Pioneer Press. Price 2 rupees.—In this brochure the author deals with the possibility of developing a very large amount of power at a low cost, in the neighbourhood of Chhindwara, which is situated in the Central Provinces of India. He details various purposes to which the power could be applied, citing numerous authorities for his data, and describes the characteristics of the district relevant to the subject, with estimates of the cost of the works, which involve the construction of a good many storage reservoirs, pipe-lines and canals, and separate generating stations. The total power available is stated to be nearly 70,000 KW., and the total cost of the power plant is put at 65,23,740 rupees, or Rs. 93 per KW. The cost of reservoirs, canals, and pipe-lines, with a small allowance for compensation to landowners, is estimated at Rs. 2,62,70,000, bringing the aggregate outlay up to Rs. 3,27,93,740, or Rs. 470 per KW. The revenue at 2 anna per unit would be Rs. 77,00,000, the working costs Rs. 6,80,000, and the profit Rs. 70,20,000 per annum.

"*Journal* of the Institution of Electrical Engineers." Vol. LVI. No. 271. February, 1918.—This issue contains the following papers :—"The Pros and Cons of the Metric System," by Mr. Ll. B. Atkinson ; "A Case for the Adoption of the Metric System," by Mr. A. J. Stubbs ; "Electrical Signalling and Control of Railways," by Mr. C. M. Jacobs.

"Science Abstracts." A and B. Vol. XXI, Part 1. January 31st, 1918. London : E. & F. N. Spon, Ltd. Price 1s. 6d. each net.

Messrs. Henry Sotheran & Co. have issued a catalogue of rare and standard books on "Exact and Applied Science" (price 2s. 6d. net), including the scientific portion of the library of the late Lord Justice Stirling, George Rennie, Samuel Roberts, and other well-known scientists ; the catalogue (which cannot be sent gratis, owing to Government restrictions) comprises 250 pages, of which some 22 are devoted to "Engineering."

"Tables of British Decimal Coinage, Metric and British Weights and Measures, &c." By A. J. Lawson, M.Inst.C.E. London : Eyre and Spottiswoode, Ltd. Price 5s. net.

LIGHTING AND POWER NOTES.

Barnsley.—Plant Extensions.—The T.C. has adopted the recommendation of the Electricity Committee as to the granting of the 12½ per cent. bonus in addition to the 20s. to the various grades in the electricity department. In moving the adoption of the minutes Alderman Rose, in referring to the wages advances, said he was afraid the financial balance of the department would be on the wrong side at the end of the year. If the Council adopted the suggested scheme of extension the total cost of the undertaking would be £76,000, that would enable the Committee to produce 4,800,000 units per year compared with only two million units in 1912, when the debt was £68,000.

Bath.—The E.L. Committee has authorised the sale of the Diesel engine set, owing to the load having outgrown the capacity of the machine, and to the prohibitive price of oil fuel. It is proposed to obtain turbine plant to replace it.

Bedworth.—Street Lighting.—The Parish Council has decided to ask the Electric Power Co. for an estimate for the lighting of the whole of the street lamps for a period of 12 months.

Belfast.—The Special Committee appointed to inquire into the working of the Corporation tramway and electrical undertakings has recommended that the present single Committee system be discontinued, and that one Committee be formed for the tramway and another for the electrical undertaking. The approval of the Corporation is a foregone conclusion.

Birmingham.—Rate Relief.—As a result of the conference last week on the question of the amounts the trading departments of the Corporation should make to the relief of rates fund for the ensuing year, the following contributions will be made :—Gas department, £30,000 ; electric supply, £25,000 ; tramways, £25,000 ; against this there is a deficit of £120,000 on the water undertaking, the balance being provided by the general rates.

Blackpool.—Price Increase.—The Electricity Committee, last week, decided that a further 5 per cent. be added to electricity consumers' accounts, to come into force on April 1st. This is due to the general increase in the cost of production, and notably in coal and wages.

Bray (Co. Wicklow).—Tar Oil.—On a report from the electrical engineer as to shortage of petroleum supply, and the risk of having to close down the day supply of current during the summer months, the Council decided to order tar-oil apparatus.

Buxton.—A Committee formed by the T.C. to consider the condition of the electricity undertaking recommends the installation of a gas-driven generating plant, and gradually to dispense with the existing steam plant ; the provision of a battery approximately double the size of the present one, the provision of a new engine-room gallery and switchboard ; a complete equipment of working tools to enable repairs to be done on the premises ; the disposal of an unused generating plant, a disabled gas engine, and obsolete fittings and sundries ; the erection of feeder pillars ; the substitution of the present public lamp fittings by more serviceable and efficient lanterns ; and the establishment of a showroom at the Town Hall. The utilisation of water power at the works, and the possibility of obtaining energy in bulk from Manchester, are also to be considered.

Colchester.—In order to bring the prepayment consumer up to the level of other consumers who are paying an increased 10 per cent. for current, the T.C. has decided to discontinue the free supply of lamps, and to levy a meter rental of 6d. per quarter as from April 1st.

Continental.—SPAIN.—La Sociedad Cataluna de Gas y Electricidad has secured a concession to establish a plant to utilise the water power of the River Ecera, near Seira (Province of Huesca), in the generation of electrical energy for lighting and power purposes.

SWEDEN.—The A.B. Jungers Elementbelysning Bolag is the name of a new company which has lately been formed in Gothenburg with a capital of about £83,000 to undertake the establishment of electric lighting plants in small towns, country houses, farms, &c.

Devizes (Wiltshire).—The T.C. has appointed a Special Committee to consider the question of lighting the town by electricity after the war.

Dublin.—PLANT EXTENSIONS.—The Council has adopted the report of the Electricity Committee recommending that application be made to the L.G.B. for Ireland for sanction to a loan of £175,000 for extensions to the electricity undertaking, as detailed in our last issue. A lengthy discussion took place on the matter, and it was pointed out that in 1916 Mr. P. W. D'Alton had advised the necessity of providing modern plant, with which the Corporation's engineers agreed. Mr. Sherlock, the newly-elected chairman of the Electricity Committee, rather doubted whether they would get the loan under present conditions, but if not, the responsibility would not be theirs.

Dundalk.—Mr. P. A. Spalding, electrical engineer to the Council, reported, last week, that during the year ended December 31st last the total number of units generated at the power station was 1,106,919, of which 518,918 units were for the Great Northern Railway (Ireland) supply, the balance being for town supply and Council purposes on the premises. The engines had been adapted, at a cost of £985, for the burning of tar oil. This expenditure had enabled a saving to be made during the year of £1,905, while the saving during the present year was anticipated at not less than £2,500. A detailed table was submitted showing the loss on the supply to the Great Northern Railway in consequence of a delay of 14 months in starting the main agreement, and of further loss in the subsequent carrying out of the agreement due to the Council's working expenses being considerably in excess of the original estimate, which was based on pre-war figures. The income of the undertaking for the nine months to December 31st last marked an increase of £1,450, but the cost of fuel and lubricating oil alone had increased by £1,305 as compared with the corresponding period of 1916.

Dundee.—Negotiations have taken place regarding an electricity supply for the new shipyard of the Caledon Co. The latter proposes erecting a sub-station and coverting its own supply; the station is to cost £7,000.

Ealing.—PRICE INCREASE.—The T.C. has decided to increase the charges for electricity from March next as follows:—Private lighting, flat rate (6½d.), to 8d. per unit, and for all other methods of charging in proportion; public lighting in proportion; cooking and heating, from 1½d. to 1¾d. per unit.

Fochabers.—A new installation has been completed at the power station on the River Spey for the Gordon Castle estate. The new set comprises a Crossley crude oil engine of 132 B.H.P., together with an 80-KW. G.E.C. belt-driven dynamo. The engine is supplied with two compressed-air starters, and can take a temporary overload of 20 per cent.

Gloucestershire Electric Power Co.'s Bill.—The Nailsworth U.D.C. has decided to join with other neighbouring public bodies in opposing the above Bill; the Stroud U.D.C., in order to protect the interest of the ratepayers, has decided to oppose the Bill jointly with the Gloucestershire C.C.

Greasborough.—PROV. ORDER.—The U.D.C. has entered into an agreement with the Rotherham Corporation whereby the Council is, amongst other things, withdrawing its application to the B. of T. for a prov. order, and has agreed to support the Corporation's application. If the Corporation's Bill is approved by Parliament, electricity will be supplied in the Council's area at the same price as that charged to Rotherham ratepayers and residents.

Hereford.—PRICE INCREASE.—The price of current for lighting has been increased by an additional 10 per cent., and that for power from 35 to 45 per cent., as from the end of the December quarter.

Hove.—PRICE INCREASE.—The Electricity Committee has adopted a scale of increased charges for lighting and power; the Aldrington rates are also increased.

Kilmarnock.—The T.C. has agreed to pay Sir Alex. Kennedy 100 guineas for a report on the electrical undertaking and 100 guineas as a retaining fee as expert adviser.

King's Lynn.—PLANT EXTENSION.—The electricity department has paid the 12½ per cent. bonus to the employés of the electricity department. It was decided to undertake extensions to the electricity works, at an estimated expenditure of £15,000, subject to the necessary powers being obtained, provided that an agreement for a supply of power was entered into with the British Farma Mills Co., who propose to establish works in the town.

Limerick.—The machinery for the erection of electric cranes at the quays has been maliciously damaged, and a special force of police was last week detailed to protect it.

London.—The Stoke Newington and Shoreditch B.C.'s have agreed to give the 12½ per cent. bonus to their employés.

Londonderry.—At a meeting of the Corporation Lighting Committee it was stated that the estimated revenue for the current year from the city electrical undertaking was £26,347, and that the output and income had increased in the past seven years by 300 per cent.

Manchester.—RATE RELIEF.—The Special Committee of the Corporation appointed to consider the basis on which the various trading committees should make contributions to the aid of the city rates, has issued its report. It recommends that the actual surplus profits of the electricity, gas, and tramway departments be paid over to the city fund, with a fixed minimum of 1 per cent. upon the aggregate capital expenditure of the electricity undertaking, 1 per cent. upon the gas undertaking, and 5 per cent. upon the tramways. The capital expenditure upon the electricity undertaking up to March last was £3,165,134, making the suggested minimum £31,651, and on the tramways £2,237,827, the suggested 5 per cent. minimum upon which is £111,891.

Midlothian.—An outbreak of fire, on Sunday, destroyed the electric power station and air compression engine house at Dalkeith Colliery, Smeaton.

Montrose.—ELECTRICITY PRICES.—The Electric Light and Power Co. has applied to the Council for permission to increase the charges for electricity other than for street lighting by 10 per cent. The town clerk was instructed to obtain information as to the charges in towns similarly situated.

Runcorn.—PROPOSED SUPER-POWER STATION.—According to the daily Press, the Mersey Power Co., of Runcorn, which is a subsidiary of the Salt Union, Ltd., has decided to erect a large new power station in proximity to the existing station at Weston Point. The immediate provision of 25,000 H.P. is suggested, with eventual development to 130,000 H.P., with the object of supplying local industries. At present a 6,000-H.P. plant is in use. It is understood that the Ministry of Munitions favours the scheme.

South Africa.—The Paarl (Cape Province) Municipality proposes to borrow £2,200 for the purpose of extending the electric lighting system in the streets.

DURBAN.—An accident of a serious nature recently occurred on the Bluff, when one of the camp natives sustained horrible injuries. In spite of a warning which had been previously given, he had attempted to get through a live electric wire fence, receiving dreadful burns, and a severe shock.

The Cape Town Council is to hold a ratepayers' meeting for the purpose of obtaining consent to an expenditure of £180,550, viz., £95,610 for generating plant, £68,000 for distribution purposes, and £16,940 for workshops.

Tottenham.—STREET LIGHTING.—The North Metropolitan Electric Supply Co. has suggested to the U.D.C. that the street arc lamps should be removed, and incandescent lamps substituted therefor. The substitution of incandescent lamps will give effect to the Council's wishes, and the engineer reports that a saving of over £1,000 per annum will be effected. The altered system of lighting is to be agreed to, and the engineer is to make the most favourable terms possible with the company.

United States.—The first section of the new power station of the Public Service Co., of Northern Illinois, near Joliet, which has recently been completed, is of interest because of the high steam pressures employed, which makes possible a higher over-all plant efficiency by increasing the upper limits of the thermal cycle. The initial plant consists of two 10,000-KW. (12,500-K.V.A.), 12,000-volt, 1,800-R.P.M. turbo-alternators, with three cross-drum Babcock boilers: the latter operate at 325-lb. pressure, and supply steam at about 300-lb. pressure at the turbine stop valve, superheated 225°, giving a steam temperature of 650° F.

The boilers are of standard type but of heavier construction; the drum plates are 1 1/16 in. thick, the longitudinal seam being a butt and double cover strap quadruple riveted joint. The high-pressure steam piping is extra-heavy and of relatively small diameter, owing to the density of the steam; on pipes above 4 in. bore a special bolted joint with a welded seal at the periphery is used, and fittings of cast or forged steel. Integral superheaters are fitted to the boilers, and economisers with wrought steel headers and galvanised drawn steel tubes are built over the latter, the gases passing through an induced draught fan to the stack. Two chain grates are fitted in a common furnace to each boiler; each 1,000 sq. ft. of boiler heating surface has 23·4 sq. ft. of grate, 313 sq. ft. of superheater, 678 sq. ft. of economiser, and 3·8 sq. ft. of stack.

Wakefield.—The electrical engineer having recommended certain extensions at the electricity works, the Ministry of Munitions and the L.G.B. are to be interviewed.

Warminster.—PROV. ORDER.—The B. of T. has extended for another year the prov. order for electric supply.

Weymouth.—As the result of inquiries, the Electricity Committee is satisfied the employés of the electricity department are entitled to the 12½ per cent. award, and has adjusted the rates of pay accordingly.

TRAMWAY AND RAILWAY NOTES.

Bradford.—At the inquest, last week, on the body of Wm. Gill, driver of the Corporation tramcar which jumped the metals and overturned on a hill on the Allerton route, it was stated that the car was the one which had been blown over by the wind in 1913, but had since had new brakes and a new under-carriage fitted. The brakes were found to be quite in order after the accident. The driver was pinned underneath the car and died. The jury, in returning a verdict of "Accidental death," thought the accident was due to miscalculation by the driver owing to the darkness and fog, and thought there ought to be more light at such a point in the dark early mornings.

Continental.—Switzerland.—New locomotives have been constructed by Messrs. Brown-Boverie & Co. for the Jungfrau Railway. The line has 6·2 km. of section operated by cogged wheels, and 3·2 km. by ordinary adhesion. The locomotives have to draw trains of 35 tons at 8·5 to 9 km. per hour on the cog-wheel sections, and at 18 km. per hour on the remaining sections. When descending, electric braking is used, the current being returned to the line. The locomotives have two axles; the electric equipment consists of two slip-ring induction motors of 125-H.P. hourly rating, and 350-H.P. maximum rating. The electric braking is ensured, even in case of the trolley not making contact, by the provision of a direct-current series machine. This machine excites two phases of the stator of the motor, so that it operates as a synchronous generator delivering current to resistances. By this means speeds of 6 to 9 km. an hour may be maintained on the cog-wheel section, and 12 to 18 km. an hour on the remaining sections. An air turbine is provided to cool the resistances. This machine is coupled to a 13-H.P. squirrel-cage induction motor and to a 6-KW. compound-wound direct-current machine, the latter being provided for supplying current for braking and lighting in emergencies. The locomotive weighs 18,020 kg., and the electrical equipment 10,000 kg.—*Zeit. des Ver. Deutscher Ing.*, December 22nd, 1917.

Glasgow.—For the period from June 1st, 1917, to February 2nd, 1918, the receipts of the Glasgow tramways have been £932,519, an increase of £103,453 as compared with the preceding year. The number of passengers was 285,654,286, as against 258,893,237 for the previous year, showing an increase of 26,761,049.

Harrogate.—Electric Vehicle.—The T.C. has approved a decision of the Highways Committee to purchase a 3½-ton electric tipping wagon, subject to the grant, by the Ministry of Munitions, of a priority permit.

Middlesbrough.—Tramway Purchase.—At a meeting of the T.C. on the 12th inst., the General Purposes Committee recommended the Corporation to exercise its right to purchase that portion of the tramways undertaking belonging to the Imperial Tramways Co. situated in the borough, and that notice be served on the company. This was agreed to, and a Committee, with powers to take the necessary steps, was appointed.

Rochdale.—Electric Vehicles.—The Cleansing Committee has provisionally agreed to the purchase of three electrically-driven lorries.

Southport.—Fares.—The Tramways Committee recommends an increase of all fares by one farthing per journey, a proportionate increase on return tickets, and reduced fare tickets for children under 15 years of age.

An application from the Amalgamated Society of Tramway and Vehicle Workers for an increased war bonus, with 21 days' notice of the withdrawal of labour, has been received by the Tramways Committee and referred to the Wages Committee.

The report for the year ending March last of the Corporation tramways, just issued, shows a net profit for the year of £719, as against £909 for the preceding year.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdare.—March 31st. Electricity and Tramways Department. Stores for 12 months. See "Official Notices" to-day.

Australia.—Melbourne.—April 5th. Department of the Navy. Motor-driven hydraulic pump. Director of Navy Contracts, Melbourne.

Belfast.—March 13th. Tramways and Electricity Committee. Six or 12 months' supply of stores, &c. See "Official Notices" to-day.

Cavan.—March 4th. B. of G. Storage battery, wiring, electrically-driven pumps, pipes, &c. See "Official Notices" February 15th.

Macclesfield.—March 18th. Cheshire County Asylum. Stores (10). Electrical goods for six or twelve months. Forms from W. G. F. Tingay, Parkside, Macclesfield.

Manchester.—March 12th. Corporation Tramways. (*a*) Permanent way special trackwork. (*b*) Copper rail bonds. General Manager, 55, Piccadilly, Manchester. Specifications for (*a*) 21s. (returnable).

Portsmouth.—March 12th. Tramways Committee. Six months' supply of tramway stores. See "Official Notices" to-day.

Warrington.—February 26th. Electricity Department. Steam pipework. See "Official Notices" February 8th.

March 5th. Electricity Department. E.H.T. switchgear. See "Official Notices" February 15th.

CLOSED.

Barnsley.—Electricity Committee. Accepted tender, Babcock & Wilcox, Ltd., £3,900, for a water-tube boiler.

Glasgow.—The T.C.'s Electricity Committee recommends the acceptance of the following offers in connection with the new generating station at Dalmarnock :—

Turbine, condensing plant, alternator and transformer.—Dick, Kerr and Co., Ltd., £98,400.

Supply and maintenance of storage batteries :—

Premier Accumulator Co., Ltd.—£4,778 for batteries, and £283 per annum for maintenance.

The engineer has been authorised to extend the contract with Messrs. Reyrolle & Co., so as to include the supply of switchgear required in connection with the additional generating plant already referred to.

Edison Accumulator Co., Ltd—Five-ton electrical motor vehicle, £1,740.

London.—Metropolitan Asylums Board. Accepted tender, Rhodes Motors, Ltd., at £20 13s. 6d., for the installation of an electric motor at Queen Mary's Hospital.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, February 22nd. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Greenock Electrical Society.—Saturday, February 23rd. At 2.30 p.m. Visit to Merino Mill.

Illuminating Engineering Society.—Tuesday, February 26th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 5 p.m. Paper on "A Survey of Methods of Directing and Concentrating Light," by Lieut. Commander H. T. Harrison.

Royal Institution of Great Britain.—Tuesday, February 26th. At 3 p.m. At Albemarle Street, W. Lecture on "A National Laboratory of Industrial Research," by Sir R. T. Glazebrook, F.R.S. (Lecture I.)

Saturday, March 2nd. At 3 p.m. Lecture on "Problems in Atomic Structure," by Prof. Sir J. J. Thomson, F.R.S.

Association of Electric Station Engineers.—Wednesday, February 27th. At the Y.M.C.A., Albion Place, Leeds. At 7 p.m. Inaugural meeting. Addresses by Messrs. Lunn & Thomas (Manchester Section).

Royal Society of Arts.—Wednesday, February 27th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "Organisation of Commercial Intelligence," by Sir W. H. Clarke.

Institution of Electrical Engineers.—Thursday, February 28th. At 2.30 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Private and informal meeting for the purpose of discussing the provisions of the Patents and Designs Bill.

(**Manchester Local Section**).—Tuesday, February 26th. At 7 p.m. At the Engineers' Club. Paper on "Large Batteries for Power Purposes," by Mr. C. C. McKinnon.

(**Students' Section**).—Thursday, February 28th. At 7 p.m. At the Northampton Polytechnic Institute. Paper on "The Testing of Pyrometers," by Mr. R. Gates.

Salford Technical and Engineering Association.—Saturday, March 2nd. At the Royal Technical Institute. At 7 p.m. Paper on "Road Transport," by Mr. H. Dodgson.

NOTES.

New Electrical Industries for After the War.—With reference to the Engineering Trades' (New Industries) Committee appointed by the Ministry of Reconstruction, we learn that a number of Branch Committees, each of which will consider a certain trade or group of trades, has been set up. Mr. John Taylor (of Messrs. Mather & Platt, Ltd.) has been appointed chairman of the Electrical Branch Committee. Any reader who has specific recommendations to make under the terms of reference concerning the electrical industry, should address communications as follows :—Mr. John Taylor, Chairman Electrical Branch Committee, Room 114, Armament Buildings, Whitehall Place, London, S.W. 1.

Inquiries.—Makers of the "Falco" electric cooking apparatus are asked for.

Concert.—On Saturday last, the new recreation hall, with seating capacity for 700, which the directors of the Sterling Telephone and Electric Co. have built and equipped with an organ and grand piano for their employés at their Dagenham Works, was crowded with an enthusiastic audience, who greatly appreciated the talented artistes whom Mr. Guy Burney, as managing director of the company, on behalf of himself and his co-directors, had engaged for a grand evening concert to signalise the opening of the hall, which contains a fine stage with footlights. The electric lighting was carried out by the electrical department of the works. In addition to well-known artistes, the Sterling Orchestral Society (conductor, Mr. H. G. Smith) gave excellently-rendered selections, and the wealth of talent which abounds at the works was also freely drawn upon. Mr. H. Nicholls was a capable stage manager, Mr. A. W. James (assistant works manager) was an able M.C., and Mr. E. Gordon Lloyd (chairman of the Sterling Athletic and Social Club) a ubiquitous chief steward.

During the evening, Mr. Guy Burney made a brief speech, and a vote of thanks was enthusiastically passed to him and to the directors.

Electrical Power Engineers' Association (The Reconstructed A.E.S.E.).—Mr. F. B. O. Hawes, hon. sec., the Electrical Trades Benevolent Association, has been asked to address the above Association at its March meeting.

Applications from senior engineers above the rank of engineer-in-charge continue to come in, and to date the Association includes 15 chief assistants and chief technical assistants among its members.

A Selection Committee has been appointed, consisting of mains engineers and charge engineers from company undertakings, and chief assistants and mains engineers from municipal undertakings.

Mr. H. W. Mortimer has been elected representative for Croydon on the Council of the Association.

An ordinary Council meeting will be held on Thursday, March 14th, at 7 p.m., at St. Bride's Institute, Fleet Street, E.C.

The A.E.S.E. in Sheffield and District.—A general meeting of the above was held in Atkinson's Café on Monday, February 11th, 1918. The following resolution was adopted:—"That a local section be formed and attached to the Manchester Branch." A Committee was afterwards elected by the members present. By the enthusiasm which was shown, and according to promises made, it is anticipated that there will be a substantial addition to the membership by the time of the next general meeting, which will be held in the course of a week or so.

Atmospheric Nitrogen Production in England.—Sir L. W. Evans states that important developments have been made in Allied and neutral countries in the fixation of atmospheric nitrogen, and that considerable supplies are becoming increasingly available. It is believed, he says, that enemy countries are now relying entirely on this source of supply for the production of explosives. Arrangements have been completed by the Ministry of Munitions for similar production on a large scale in this country, and it is probable that, in order to save tonnage and owing to the length of the voyage from Chile, it will be found necessary to develop this policy still further. This source of supply is also expected to be of great value after the war for the production of fertilisers.—*The Times.*

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending March 2nd, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Officer for the Week.—Lieut. P. Bowden.

Next for Duty.—Lieut. W. J. A. Watkins.

Monday, February 25th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, February 26th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, at 7.30.

Wednesday, February 27th.—No. 1 Company, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, February 28th.—No. 2 Company, Knotting, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, March 1st.—Musketry, 5.30—8.

Saturday, March 2nd.—Entrenchments, &c., for the whole corps, 2.45—4.45. Recruits, 2.45—4.45.

Special Notice.—All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

Foreign Trade.—The January Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	January, 1918.	*Inc. or dec.*
Imports.		
Electrical goods	130,947	+ 12,045
Machinery	686,868	— 13,850
Exports.		
Electrical goods	135,684	— 141,249
Machinery	1,263,235	— 216,896

The A.S.E. and Man Power.—The voting of the Amalgamated Society of Engineers, on the question of accepting or rejecting the Government's man-power proposals, was as follows:—In favour of accepting, 27,470; against, 121,017; majority against, 93,547.

The Labour correspondent of the *Daily Telegraph* states that the present membership is 275,000 approximately. Allowing for those on active service, in the Colonies, or under 18 years of age, the effective voting power is 215,000, of whom only 148,487 have voted. Therefore, 66,513 have not voted.

Board of Agriculture Electroculture Committee.—The announcement is made that the President of the Board of Agriculture and Fisheries has appointed a Committee to advise in regard to all electrical questions in connection with the carrying out of experiments in electroculture, and particularly in regard to the construction of apparatus suitable for use on an economic scale, and to the making of such electrical measurements as may be necessary in connection with the experiments.

The Committee is constituted as follows:—Sir John Snell, M.Inst.C.E. (chairman), Mr. A. B. Bruce, M.A., Prof. V. H. Blackman, F.R.S., Dr. Chree, F.R.S., Mr. W. R. Cooper, M.A., Dr. W. H. Eccles, M.I.E.E., Mr. J. S. Highfield, M.I.E.E., Prof. T. Mather, F.R.S., Dr. E. J. Russell, F.R.S., and Mr. C. T. R. Wilson, F.R.S.

Mr. B. W. Phillips, of the Board of Agriculture and Fisheries, will act as secretary to the Committee, and all communications should be addressed to him at 4, Whitehall Place, S.W. 1.

Revision of Charges under Existing Contracts.—Mr. H. Faraday Proctor has received a letter from the Ministry of Munitions with regard to the revision of charges under existing contracts for electricity supply, made necessary by the adoption of the 12½ per cent. award, stating that in general the business of electrical undertakings may be allocated to the following classes of consumers, viz.:—

1. Consumers with long-term contracts at pre-war rates, whose works are "controlled establishments."

2. Consumers with long-term contracts at pre-war rates, whose works are uncontrolled.

3. Consumers—both for power and light—supplied under contracts which are alterable by short notice.

With regard to the first class, the Minister is of opinion that a reasonable advance in price should be paid for energy supplied to controlled establishments, provided that the following conditions are observed, viz.:—

1. That so far as possible all classes of consumers shall be similarly dealt with; that is to say, that the burden shall be spread over all classes, although not necessarily by an addition of the same percentage advance in each case.

2. That the revenue resulting from an advance in prices shall, if more than sufficient to show the same return on capital as was earned during the financial year prior to the outbreak of war, after setting aside the same rate for depreciation or reserve, be dealt with in such manner as the Minister may decide.

3. That any advance in price under long-term contracts shall continue only during the period of Government control, unless the consumer otherwise agrees.

With regard to the second class of consumers, the Minister is of opinion that such consumers should voluntarily comply with the demand of the public service undertakings for a temporary advance in price on similar terms to those proposed in the case of the first class, and in this opinion the Board of Trade concur. Should difficulty be experienced in securing by consent an increase in price from uncontrolled establishments still paying pre-war rates for energy, procedure is open to suppliers under the Courts Emergency Powers Acts, but the Minister hopes that in very few cases would it be necessary to have recourse to this procedure.

With regard to the third class of consumers, the Minister understands that charges have been increased more or less generally, and that as a rule there is still a margin within the prescribed maximum prices which would permit of a further increase if necessary; but in the case of those undertakers whose Act or Order provides for a revision by the Board of Trade of the maximum prescribed, it is understood that the Board are prepared to consider applications on their merits.

Industrial Management.—A group of large firms engaged in the principal industries of the Manchester district has offered to the Governing Body of the School of Technology the sum of £3,000, spread over a period of five years, towards the cost of establishing a new department of industrial management. It is proposed that a lecturer should be appointed for this period of five years at a salary of £600, to conduct research in the subject of industrial management, to organise a new department, to lecture to members of the University and to the public, and to assist industrial concerns in the solution of management problems. A number of managers, directors, scientific experts, and others who have had special experience or are responsible for important innovations, will also be invited to deliver public lectures, being offered substantial fees which will not only pay them for placing their knowledge at the disposal of their fellow-managers, but serve to encourage enterprise and experiment in matters connected with management.

Appointments Vacant.—Charge Engineer (£196), for the Borough of Sunderland Electricity Department; charge engineer (70s.), for the Wakefield Corporation Electricity Department; station engineer (£3), for the Northern Command power stations; charge engineer (58s.); junior draughtsman for the Paisley Corporation Electricity Works; engineer (£225) for the L.C.C. Tramways Department. See our advertisement pages to-day.

The Cape Town City Council has been inviting applications for the position of assistant city electrical engineer, at £700 per annum.

Trade Marks.—The Trade Marks Committee of the Federation of British Industries has decided to oppose Part 2 of the proposed new Government Bill "To Amend the Trade Marks Act, 1905," on the ground that it will inflict serious injury on the owners of perfectly legitimate trade marks. Part 2 deals with "Provisions for the Prevention of Abuses of Trade Marks." It has also been decided by the same Committee that the proposed British Empire Trade Mark should be opposed.

Electric Lighting and Engine Starting Sets for Motor-Cars.—In connection with the discussion as to whether the operations of electric lighting and engine starting on petrol motor-cars should be carried out by separate machines or combined in a generator-motor, it is interesting to learn, as indicating the current practice in America, that out of 72 different makes of cars displayed at the recent Motor-Car Exhibition in New York, no fewer than 56 were fitted with the double-unit variety—that is, separate generators and motors—while on only 16 was the single-unit form adopted. In two cases the makers were apparently undecided, as on one model of car the one variety was adopted, while on a larger car the other form was installed.

Manganese Dioxide.—Practically inexhaustible deposits of manganese dioxide, which is extremely valuable as an iron-toughening material and in great demand for war munition purposes, have been found in the Cypress Hill, in South-East Alberta, Canada. Eight hundred thousand tons, worth approximately £11,000,000, have been blocked out by ordinary post-hole augers in the last few months.—*Science.*

Educational.—In a Report on the Education (No. 2) Bill, the British Science Guild expresses its cordial approval of the provision made in the Bill for the general development and organisation of all forms of education other than elementary; practical instruction for all elementary school children, provided that such teaching does not involve direct instruction for a trade: continuation schools, and compulsory attendance thereat for 320 hours per annum; the co-operation of Local Education Authorities by means of the formation of federations; abolition of exemption from attendance at school between the ages of five and fourteen; further restrictions as to the employment of children, and other features of the Bill. The Guild recommends that provision be made in the Bill for the inspection of all schools not now liable to inspection, and the adequate registration of all schools and other educational institutions.

Institution and Lecture Notes.—Physical Society of London.—At the meeting held on January 25th, the presidential address was delivered by Prof. C. V. Boys, F.R.S. Referring to the Daylight Saving Act, he said that scientifically the thing was a sham, and as such was naturally distasteful to them; but the community at large was not scientific, and had a very vague notion of the meaning of time. In the stress of war the public had realised the desirability of starting the day earlier to save, not daylight, but paraffin and gas, and the simple operation of putting all the clocks wrong, though hateful in principle, did not disturb the public at all. With reference to the question of the metric system, this was important in relation to education. He believed the reason why English schools were so backward in mathematics was that so much of the available time had to be devoted to memorising tables of weights and measures and similar mediæval relics.

Another matter of public importance was the recognition of science as an element of general education. It was sometimes urged that our officials need not be scientific, because they could get all the scientific advice they wanted. But they might not know when they required it, or appreciate the force of it when they got it. He might instance in this connection the wasteful method of street darkening which still prevailed after three years. The annual trouble with frozen water pipes was another example of the general ignorance of scientific principles. Burst pipes were unknown in really cold countries, where the elements of common sense were allowed to prevail.

All his own contributions to physical science had been experimental, and some words on the art of experiment might not be out of place. In order to succeed as an experimentalist it was necessary to find by personal experience how as many materials as possible behaved under as many conditions as possible, and this could only be done by one who would practise every art and use every tool and instrument that he could. While endeavouring at first to imitate the practices of the professional mechanic and acquire as much of his skill as possible, the experimentalist must not be bound by tradition and custom in his methods. It was the slavery to tradition and practice that made the assistance of the professional so tiresome to the experimentalist. In this connection a saying of Fresnel had greatly impressed him—"If you cannot saw with a file and file with a saw you will be no use as an experimentalist," or words to that effect. He had made it his business to use every tool and to handle every material that he could.

At the annual general meeting, held on February 8th, the officers and Council for the ensuing session, as proposed on the balloting list, were unanimously elected. These included:—President, Prof. C. H. Lees, D.Sc., F.R.S.; vice-presidents, Prof. J. W. Nicholson, Prof. O. W. Richardson, Dr. S. W. J. Smith, Dr. W. E. Sumpner; secretaries, Dr. W. Eccles, City and Guilds Technical College, Leonard Street, E.C. 2; Dr. R. S. Willows; foreign secretary, Sir R. T. Glazebrook, C.B.; treasurer, W. R. Cooper, M.A., B.Sc.

The President announced that Dr. R. S. Willows was resigning his secretaryship, on leaving London; and the Council had appointed Dr. H. Stanley Allen in his place.

A paper on "A Recording Thermometer" was read by Prof. C. V. Boys.

Diesel Engine Users' Association.—The first meeting of the Association since the election of its new President, Mr. Napier Prentice, was held on January 31st. Further additions to the list of members and "subscribers" were announced. The Hon. Secretary reported recent communications with the Controller of Munitions Mineral Oil Production in connection with the subject of fuel oil supplies and the use of tar oil as fuel in Diesel engines. He further reported the appointment by the Controller of a Committee to assist him in these matters, especially in connection with applications for licences to use tar oil, and methods to adapt Diesel engines for the use of tar oil. This Committee is to be styled the Heavy Oil Engine Fuel Committee. It is composed of the nine members of the General Committee of the Diesel Engine Users' Association, to which have been added two further members nominated by the Institution of Electrical Engineers. The hon. secretary of the new Committee is Mr. Percy Still, M.I.E.E., and the offices are at 19, Cadogan Gardens, S.W. 3. Mr. John Milton read some notes giving the results of his experience in the use of tar oil as fuel in Willans-Diesel engines without pilot ignition apparatus.

Society of Engineers.—In his presidential address to the Society on Monday last, Mr. W. B. Esson referred to the fact that 60 years ago shipbuilding and engine building were great industries on the Thames. Ships of war, the finest ocean-going steamers, and the fastest sailing vessels were built on the Thames. Not a keel was laid on the Thames now. There was much business done in ship repairing, but shipbuilding had departed from the Thames, and with the launch of the super-Dreadnought *Thunderer* in 1911 the long history of shipbuilding on the Thames was closed. With the gradual disappearance of the wooden sailing ship and the development of the steel steamship, the shipbuilding yards in the South were no longer able to compete with those in the North, which were close to both iron and coal.

Institution of Electrical Engineers.—Among those present at the monthly meeting of the Scottish Local Section, when Prof. Magnus MacLean gave his Kelvin lecture, were Mr. Wordingham, the President, Mr. Rowell, the secretary, and Colonel Malcolm, of Poltalloch, whom the chairman (Mr. Arch. Page) described as the only surviving original member of the Institution. Colonel Malcolm explained that a brother officer of his, Colonel Webber, was in charge of some telegraph sappers in London, and made the acquaintance of Sir William Siemens; they discussed the advisability of forming some organisation, and he was invited by Colonel Webber to join it. The three began the work in a modest way, and were soon joined by others. He had not much directly to do with the founding of the Institution, being then at Chatham on military telegraph and military submarine work, but there was one thing which he did for them. There was a movement to get money, and it was proposed to turn this necessity into an opportunity for admitting female telegraph operators as members of the Institution. He strenuously opposed that, and saved the society, which was now one of the most important technical institutions in the world.

Mr. Wordingham said it was essential to progress that they should have co-operation among the various electrical bodies and institutions, and he knew of nothing which would tend to the promotion of such joint action so much as the establishment of an engineers' club. The Manchester club had exercised a great influence already, and he looked forward to the establishment in all important centres of similar clubs, by themselves or in conjunction with other industries. In many centres the necessity for such clubs was acutely felt. Speaking of the activities of the Institution, Mr. Wordingham acknowledged the valuable assistance lent by the Scottish members in the production of a series of rules for the Institution governing the equipment of ships, a proposition which was now nearing completion. He hoped that before the rules were published they would be brought in draft form before the Local Sections for discussion. Important research work was being carried out, and they had a number of active committees and sub-committees working in the closest possible touch with the B.E.A.M.A., while they were also taking part in the work of amending the Patent Law. They were also engaged in the movement for the establishment of an electrical clearing house for British manufactures, and had arranged for a joint meeting with doctors in connection with the application of electricity to medical treatment and healing.

Mr. C. P. Sparks has been appointed by the Council to be a member of the Committee of Management of the Benevolent Fund, in place of the late Mr. W. Duddell, and Mr. C. H. Wordingham, President, has been appointed representative of the Institution on the Governing Body of the Imperial College of Science and Technology, for the same reason.

The Committee of the Privy Council for Scientific and Industrial Research has made a supplementary grant of £87 10s. to the Institution for the Research on the Heating of Buried Cables.

With regard to the special general meeting held on November 29th, 1917, to consider the question of the expulsion of a member, when the matter was referred back, the Council finds that, under the Articles of Association, it is unable to take action upon the reference.

A private and informal meeting of members of the Institution will be held at the Institution of Civil Engineers, Westminster, on Thursday, February 28th, at 2.30 p.m., for the purpose of discussing the provisions of the Patents and Designs Bill.

Junior Institution of Engineers.—A meeting was held recently at Newcastle with a view to the formation of a Local Section of the Institution, and a resolution to that effect was carried. Mr. N. Thornton, 13, Nun's Moor Road, Fenham, Newcastle-on-Tyne, is the local hon. secretary.

Wages Award.—Among recent decisions given by the Committee on Production and the Special Arbitration Tribunal is the following:—British Insulated and Helsby Cables, Ltd.—Men of 21 and over, and paid as plain time workers, bonus of 12½ per cent.; pieceworkers and others on systems of payment by results, 7½ per cent.

Water Power in the U.S.A.—Recent important developments in Washington indicate that the Administration proposes to accomplish something definite in the development of the water power of the country. For several years past there have been independent programmes in the House and Senate covering the development of water power on the public domain and on navigable streams, but due to a lack of co-ordination of the several Governmental departments involved, nothing of consequence has resulted. Senate and House apparently have taken irreconcilable positions in the past. Both have passed measures, but neither has been able to agree with the other.

Hitherto the attempt has been made to pass separate measures pertaining to water power on navigable streams and on the public domain, but the present effort is directed towards a co-ordination of the interests of the three departments concerned.

The new Administration Bill provides for a Federal Power Commission, to be composed of three Cabinet officers—Secretary of the Interior, Secretary of Agriculture, and Secretary of War. It provides for an executive officer of the Commission, who shall be appointed by the President for a term of five years. It provides for the payment of rentals of not less than 10 cents per H.P. per annum, a feature to which there has never been objection of consequence by any interest. The Commission is empowered to grant licences to develop water power on public lands and navigable streams for a term of 50 years. At the end of the licence period the licensee upon application for a new licence shall remain in undisturbed possession until the proposed Commission shall have done one of three things: First, issue a new licence under laws at that time applicable; second, give a licence to a new licensee, who shall pay for the original fair value of the property; or, third, take the property over upon paying for its fair value. Fair value is defined to include actual cost of property taken plus severance damages for all property not taken over and damaged by reason of severance. Fair value does not include any allowance for enhancement of values on land or water rights granted by the United States, or goodwill, going value, or prospective revenues. The Bill provides for alteration, amendment, or repeal by Congress, which expressly reserves such rights, but in case of alteration, amendment, or repeal such shall not extend to the licensees who have exercised rights or spent money under the Bill.—*Met. and Chem. Engineering.*

Russian Water-Power Legislation.—A Petrograd journal says: The Ministry of Ways of Communication estimates the reserves of water power in Russia at 12,000,000 H.P. Various inquiries have increased this estimate to 20,000,000 H.P. Until recently in Russia only 1,000,000 H.P. were used, while for turbine installations less than a quarter of the total quantity of the local available water power was used. One of the chief reasons of the limited use of the water-power wealth of Russia is the lack of special legislation on the subject on the basis of which development might proceed. Besides this, the business of using the water power of the country has generally remained, says an official report, without a definite control. It has not been allotted to any one Ministry; hitherto the Imperial Duma has not paid attention to it, and no department hastened to appropriate it. In considering the estimates of the Department of Government Landed Property for the year 1913, the Imperial Duma showed the necessity of the earliest possible preparation of a project of law stating the legal regulations for granting water power to industries. The previous Chief Government of Land and Agriculture then began the preparation of a plan with the intention of keeping the business in that department. But the Minister of Ways of Communication, in his turn, submitted a detailed *projet de loi* to the Council of Ministers subjecting the business of the use of the water power to this Ministry. The leading principle of the Government regulation showed, however, according to the general and governing acceptance of this law, that only those watercourses were to be subjected to the Government control which, by special Government decrees, were proclaimed as of Government and of communal importance. The Ministry of Land, on the contrary, considered it necessary to extend the operations of the law to all watercourses of over 300 H.P. Subsequently the Ministry of Trade became interested in the problem of white coal in connection with the bearing of the acute fuel crisis upon industry. It was considered that in view of the importance which hydro-electric installations acquired for industry, the Ministry of Trade should assume the rôle of proprietor in the business. One cannot estimate how much time might have been spent in the struggles of the different departments on the various projects, if the revolution had not cut this Gordian knot along with others. The general moral upheaval and the general accession of fresh social strength played a useful part here, for by agreement of the three interested Ministries a provisional law on the use of water power was prepared and carried through the Provisional Government in the course of two or three weeks. Such a rapid decision on the question was due to two circumstances. The whole matter was handed over to the newly-formed extra-departmental Committee for the Use of Water Power, and in place of the exhaustive and cumbrous projects of the Ministries of Ways of Communication and Land, it was decided to limit them to basic principles on condition that the further regulation of the question should be carried through by the Committee itself. The importance of the law lies in the recognition of the Government's right to dispose of all the water power units of the country, in so far as such may be exploited by means of hydro-mechanical installations. (Paragraph 1 says:—"Only on the basis of concessions and permits granted by the Government.") The law does not limit the extent of such installations; and for their construction it is necessary to obtain a concession from the Government. Such a limitation is one of the delicate points of the whole problem of white coal use; as it is difficult, or even generally impossible, to find a criterion that would be sufficiently elastic whilst adequately dealing with the problem of definition. The law, therefore, charges the Committee with the limitation of the various installations and the fixing of the most accurate possible conditions for their existence, and requires it to prepare and submit suitable regulations for the approval of the Provisional Government. Until the confirmation of these rules the basic principle of each concession is subject to legal review. The alienation of river-course lands and their modification for the construction of installations and of lines for the transmission of electrical power is more fully regulated by the law. The law allows compulsory alienation for all installations of not less than 300 H.P., as well as for installations of less power which by special order of the Committee are recognised as of Government or communal importance. On the very difficult question of compensation for compulsory alienation of lands or properties, the law, however, lays down complete regulations. Another novelty is found in the categorical refusal to the riparian proprietors of compensation for such profits from the alienated watercourses as are not being used by them at the moment of alienation. In other words, the value of the water power, as such, will be compensated for to the owner of the water wheel or turbine, but not to the riparian owner who has not yet used his watercourse, although it may have been specially acquired by him for the use of the water power. The last paragraphs of the law are devoted to the organisation and definition of the function of the Committee on Water Power.

B. of T. Tramways Committee.—At a conference of tramway authorities in Newcastle-on-Tyne, the Board of Trade representatives mentioned that the tramway resources of the country were for the present national purposes to be regarded as pooled, and available for all the undertakings when necessary.

It is recommended that Mr. Hume, Mr. A. H. Scott, and Mr. J. H. Bruce shall represent the L.C.C. Tramways at the conference of undertakings to be held in London on the 27th inst. in connection with the appointment of local Advisory Committees to assist the B. of T. Tramways Committee.

Summer Time.—This year "Summer Time" is to begin on Sunday, March 24th, and continue until Sunday, September 29th.

A Light Detector for the Blind.—M. F. Hames, writing in *L'Industrie Electrique*, makes the following suggestions for a light detector which might do something to alleviate the terrible plight of the many hundreds totally blinded during the war. The detector itself would comprise a thermo-couple (such as is used in one type of Féry pyrometer) placed at the focus of a lens or parabolic reflector. Two such detectors could be mounted to form a pair of spectacles. The receiver would be a special type of telephone receiver, consisting of a coil through which passes current from the thermo-couples, and a soft iron diaphragm traversed by intermittent current from a small Ruhmkorff coil. When light falls upon the thermo-couples in the eye-pieces, the bobbin in the receiver produces a magnetic field, and interaction between the latter and the intermittent current in the diaphragm causes the iron plate to vibrate. The intensity of the note emitted should make it easy to determine the direction of the sun or of a lamp or window, and to "see" whether a lamp is alight, and so forth. Experience in the manufacture of such instruments would doubtless lead to improvements, and it is quite likely that they would prove more useful to a blind person than can be conceived by anyone who has not been deprived of his sight. The receiver could be held to one ear by the spectacle frame, and the Ruhmkorff coil and dry cell or accumulator could be carried at the waist or in the pocket. It would be an act of mercy to investigate and develop to the utmost the practical possibilities of this suggestion. We may point out that it is not at all necessary that the detector should be carried on the face.

Calorised Iron for Thermo-couples.—O. L. Kowalke, in the *Proceedings* of the American Electrochemical Society, states that there are available several thermo-couples with iron as one of the elements which have high electromotive forces and are fairly constant, but have the disadvantage that the iron element oxidises rapidly above 500° C. If iron could be protected from oxidation by some sort of coating which would not greatly change the electromotive force, its usefulness as an element for thermo-couples would be greatly extended. It has been shown by W. E. Rudder that "calorising" iron, which consists in producing a rich aluminium alloy upon the surface of the metal, practically prevents oxidisation below 1,000° C. The author has compared the thermo-E.M.F.'s of couples of calorised iron-constantan with that of uncalorised iron-constantan, and finds that they are identical up to 1,000° C.; he concludes that a heavy wire, lightly calorised, gives as constant results as uncalorised iron and has a much longer life. —*Journal* of the Franklin Institute.

A Large American Electric Steel Furnace.—The largest electric furnace in the United States is at work in the steel department of the Carnegie Steel Co., at Duquesne. It is of the Héroult type, and has a capacity of 20 tons, but has made as much as 25 to 30 tons. It began work in November, 1916, and requires 175 KW.-hours per ton of steel, operating basic on hot metal. There are three electrodes of 12-in. graphite, and the electrode consumption is now from 3 to 4 lb. per ton of steel. The current is three-phase, received at 6,600 volts, and is transformed to 100 volts at the furnace. Six heats are made per day of 24 hours, and each heat averages about 2½ hours. The steel produced by the furnace is used principally for small gun forgings, ball races, and steel balls. —*Iron and Coal Trades Review*

Useless Railway Work.—According to the New York correspondent of the *Times*, a statement made by Mr. Henry Ford occupies the foreground of the discussion of the railway problem. He makes the following criticism of the railway service:—The freight car weighs as much as the load it generally carries. It travels two-thirds full and comes back empty. Passenger trains weigh 50 to 150 times as much as the passengers in them. A Pullman car weighing 30 to 40 tons averages less than a ton of passenger load. Four-fifths of the work of a railway to-day is hauling the dead-weight of its own wastefully heavy engines and coaches. This is why railway presidents have such a hard time to figure out freight and passenger rates high enough on 20 per cent. of the live load to cover the cost of hauling this enormous 80 per cent. of dead-weight around. Nature has distributed alloy materials which, with heat treatment, make steel of 75 or 100 tons tensile strength instead of 25 tons. And then the weight can be cut down proportionately. Alloy steels of high tensile strength cut down the weight of truck and automobile.

This criticism applies also to electrical vehicles of all kinds, and calls attention to a matter of great importance.

Time Signals between the Eiffel Tower and Switzerland.—On the outbreak of war the Swiss Federal Government seized the apparatus at all wireless stations, so that these stations could no longer receive the daily time signals from the Eiffel Tower. At the urgent request of several establishments which have no longer the means at their disposal for checking the time, the Swiss Telegraph and Telephone Administration decided to arrange for the re-transmission, by telephone, of the radio-telegraphic signals given by the Paris Observatory. Since August, 1916, Swiss telephone subscribers have thus been able to receive, by telephone, each day between 10.56 and 11 a.m., the Eiffel Tower signals transmitted to Berne and repeated simultaneously. A recent communication by Monsieur Paul Ditisheim to the Swiss Geophysical Society states that this service has worked perfectly, and that the signals transmitted vary not more than ± 0·087 second from the time as transmitted from Paris.

Electric Precipitation of Solids.—Since hot smelter smoke rises higher and diffuses so much more readily than colder smoke, the Cottrell process is supplanting the baghouse for clarifying the gases from solids. Baghouse operation depends upon relatively low temperatures, 200° F., or thereabouts. Hence in general a great deal of heat must be taken out of the roaster gases if they are to be sent more or less directly through the bag-house, and loss of heat means that the height to which such cooled gases will rise will be proportionate to the amount of heat remaining in them. The Cottrell process of clearance permits much higher gas temperatures, thus supplanting the baghouse.—*Met. and Chem. Engineering.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Mr. V. Bradshaw, of Wigan, has been appointed to the position of chief assistant electrical engineer to a national filling factory.

Mr. L. Woodman, electrical engineer to the Dover Corporation, and Mr. E. Carden, manager of the tramways, have resigned their appointments.

The Buxton T.C. has increased the salary of the acting electrical engineer to £215 a year, rent and rates.

Company-Sergeant-Major H. P. Baynham, formerly superintendent at the Carlisle municipal electricity works, who joined the Royal Submarine Mining Corps in March, 1915, has been granted a commission.

The Faversham T.C. has increased the salary of the electrical engineer, Mr. G. Sommerville, from £200 to £250 a year as from October last, making his total emoluments £280.

Londonderry Electricity Committee has increased the salary of Mr. R. V. Macrory, electrical engineer, by £200 per annum, making it £600, on account of increased work and responsibility.

Mr. J. A. Robertson, borough electrical engineer of Salford, has received information that his son, Second-Lieutenant C. A. Robertson, who was reported missing on November 30th last, is a prisoner of war in Germany, and slightly wounded.

The Salford Corporation has decided to increase the salary of Mr. J. A. Robertson, borough electrical engineer, by three annual advances of £100, £100, and £50 respectively to a maximum of £1,250, the first advance to commence as from April 1st, 1917. The Corporation has also adopted a scale of salaries under which the maximum salaries of the staff will be increased as follows:—Deputy engineer, from £340 to a maximum of £500 per annum; mains engineer, from £300 to £375; station superintendent, £250 to £375; charge engineers, £200 to £250.

General.—Mr. J. H. Sandiford has resigned his position in the switchgear department of Messrs. Ferranti, Ltd., Hollinwood, in order to take up an appointment with Messrs. Ferguson, Pailin & Co., Ltd., as their engineer and representative for the London district. A presentation of an electro-plated tea set was made by Mr. J. Denham, the manager of the department, on behalf of the staff.

Dr. H. E. J. G. du Bois, of the Berlin University, has lately received an appointment from the Dutch Government as Principal of a new Electricity and Magnetism Department at the University of Utrecht.

Roll of Honour.—Private S. Hay, of the Essex Regiment (Territorials), was killed in action in Palestine. He was formerly employed at the Bognor electricity works.

S. Stocks, E.R.A., of H.M. Navy, who is reported missing, aged 31, was employed at Accrington Corporation electricity works.

Private A. Weaver, Cheshire Regiment, killed in action, aged 26, was employed by B.I. & Helsby Cables, Ltd., Helsby.

A.B. William Agnew, who was in the employ of the British Westinghouse Co., Ltd., Trafford Park, and previously an electrician in the service of the White Star Line, is officially reported drowned at sea on January 31st. He was 27 years of age.

Sapper T. Maudsley, R.E., who was prior to the war electrician to Major Fermor-Hesketh, of Rufford Hall, is reported killed.

Lance-Corporal H. Booker, Royal Fusiliers, who has fallen in action, enlisted from the works of the Telegraph Construction & Maintenance Co., East Greenwich.

Mr. F. J. Salter, who has died after being invalided from the A.S.C., was prior to the war engaged at the L.C.C. generating station at East Greenwich.

Private C. Broadbent, who had died of wounds, was an electrical engineer, and belonged to Douglas (Isle of Man).

Wireless Operator E. Hollamby lost his life by the sinking of H.M.S. *Raglan*.

Gunner G. Spooner, R.F.A., who was engaged with Messrs. Bullers, Ltd., of Hanley, is reported missing.

Will.—The late Mr. J. C. Merryweather (Merryweather and Son, Greenwich) left £135,975 gross and £131,980 net personalty.

NEW COMPANIES REGISTERED.

Tees Power Station Co., Ltd. (149,607).—Registered February 13th. Capital, £700,000 in £1 shares. To acquire from the Newcastle-upon-Tyne Electric Supply Co., Ltd., a piece of freehold land at Billingham, Durham; to erect thereon a generating station for electrical energy, to erect any similar stations elsewhere, to enter into an agreement with the said Newcastle Co., or any of its associated companies, for operating the said station or stations, to utilise and sell gases, waste heat, and other products, to supply electrical energy, to construct, lay down, establish, and fix cables, wires, lines, accumulators, motors, lamps, and works, to carry on the business of electricians, mechanical engineers, &c. The subscribers (each with one share) are:—J. S. Watson, Royal Exchange Buildings, Newcastle-on-Tyne, engineer; H. A. Bowes, Royal Exchange Buildings, Newcastle-on-Tyne, engineer; R. Harrison, Royal Exchange Buildings, Newcastle-on-Tyne, clerk; H. E. Nelson, 1, Maritime Terrace, Sunderland, clerk; T. Chrisp, 8, Kensington Gardens, Monkseaton, clerk; G. N. Nicholson, Royal Exchange Buildings, Newcastle-on-Tyne, accountant; E. S. Patterson, 11, Sydenham Terrace, Whitley Bay, cashier. Minimum cash subscription, seven shares. The first directors are:—J. H. Armstrong and R. P. Sloan. Qualification, £100. Directors must be British subjects. Remuneration as fixed by the company. The articles contain various clauses prohibiting foreign control. Registered office: Royal Exchange Buildings, Newcastle-on-Tyne.

White Electrical Instrument Co., Ltd. (149,605).—Private company. Registered February 12th. Capital, £10,000 in £1 shares. To take over the business of an electrical and scientific instrument manufacturer carried on by Kate I. B. White, at 3-6, Gloucester Street, Clerkenwell, as the White Electrical Instrument Co. The subscribers (each with one share) are:—Mrs. Kate I. B. White, Woolacombe, Wood Street, High Barnet; C. E. Cox, 108, Wellington Road, Bush Hill Park, N., manager; T. J. Nance, 19, Petworth Street, Battersea, S.W., secretary; W. Maskell, 7, John Street, Bedford Row, W.C., solicitor. The first directors are:—Mrs. Kate I. B. White and C. E. Cox (managing director). Qualification, £100. Registered office: 2-4, Gloucester Street, Clerkenwell, E.C.

E. G. S. Co., Ltd. (149,613).—Private company. Registered February 13th. Capital, £20,000 in £1 shares (10,000 6 per cent. cum. pref.). Electricians, electrical and mechanical engineers, manufacturers of accessories and appliances for ships and vessels, oil merchants, drysalters, manufacturers of and dealers in chemical preparations, motor vehicle manufacturers and dealers, &c. The subscribers (each with one share) are:—Major J. L. Marr, Russell Hotel, London; W. B. Marr, Glenville, Roker, Sunderland, electrical engineer; J. Dodds, Winifred House, Cleadon, *via* Sunderland, electrical stores merchant. The first directors are:—Major J. L. Marr, W. B. Marr, J. Dodds (managing director), and J. Marr. Qualification, £100. Registered office: Pudding Chare, Newcastle-on-Tyne.

Medical Supply Association, Ltd. (149,598).—Private company. Registered February 12th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in surgical instruments, medical appliances, X-ray and electromedical apparatus, orthopædic, anatomical and dental appliances, boots, stays, artificial eyes and limbs, bandages, crutches, chairs, stretchers, ambulances, chemicals, drugs, and hospital requisites, &c. The subscribers (each with 50 shares) are:—Mrs. S. Greville, 21, The Avenue, Kew Gardens, S.W.; Ernest E. T. B. Greville, 21, The Avenue, Kew Gardens, S.W., M.D., surgical instrument maker. The first directors are:—E. T. B. Greville, Mrs. S. Greville (permanent), Captain E. R. G. Greville, R.A.M.C., and Mrs. E. Howes. Registered office: 167-185, Gray's Inn Road, W.C.

Metallic Electrical Engineering Co., Ltd. (149,515).—Private company. Registered February 2nd. Capital, £15,000 in £1 shares. To take over the business of tube factors and electrical engineers carried on by the Metallic Seamless Tube Co., Ltd., at Corporation Street, Birmingham, and elsewhere, as a branch of their general business of tube makers. The subscribers (each with one share) are:—G. Y. Iliffe, Hazelhurst, Russell Road, Moore Green, Birmingham, manufacturer; A. E. Beck, High House, King's Norton, Worcs., engineer. The first directors are:—G. Y. Iliffe, A. E. Beck, G. O'Connor Holloway, F. W. Bayliss, and W. H. Bowater (all permanent). The Metallic Seamless Tube Co., Ltd., may, while holding three-fourths of the paid-up capital, appoint directors. Soliciter: T. W. Horton, 4, Bennetts Hill, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Harrow Electric Light & Power Co., Ltd.—Memorandum of satisfaction in full on June 1st, 1917, of mortgage dated December 31st, 1900, securing £1,325, has been filed.

A. Vernon Ward (Manchester), Ltd.—Memorandum of satisfaction in full between June 16th, 1917, and January 25th, 1918, of debentures dated February 6th, 1917, securing £500, has been filed.

Electrical Contracts & Maintenance Co., Ltd.—Memorandum of satisfaction in full on December 19th, 1917, of debentures dated December 5th, 1916, securing £1,000, has been filed.

British Electrolytic Zinc Co. (Isherwood Process), Ltd.—Issue on September 17th, 1917, of £3,800 debentures, part of a series of which particulars have already been filed.

Costa Rica Electric Light & Traction Co., Ltd. (56,447).—Capital, £120,000 in £1 shares. Return dated January 11th, 1918. All shares issued; £7 paid; £129,993 considered as paid. Mortgages and charges: £286,650.

City of Freetown (Sierra Leone) Electricity Co., Ltd. (138,058).—Capital, £15,000 in £5 shares. Return dated December 31st, 1917. 200 shares taken up; £1,000 paid. Mortgages and charges: Nil.

Consolidated Signal Co., Ltd. (71,141).—Capital, £425,000 in 220,000 pref. and 205,000 ord. shares of £1 each. 214,195 pref. and 150,548 ord. taken up to December 25th, 1917; £52,839 paid on 24,999 pref. and 27,840 ord.; £311,904 considered as paid on 189,196 pref. and 122,708 ord. Mortgages and charges: Nil.

Bastian Electric Co., Ltd.—Issue on February 4th, 1918, of £200 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

London Underground Electric Railways.

London Electric Railway Co.—The aggregate gross traffic receipts of the five companies parties to the Common Fund Agreement (City & South London, Central London, London Electric, Metropolitan District, and the L.G.O. Companies) were £5,843,201. The aggregate gross receipts of the five companies from all sources were £6,661,863. The aggregate amount retained by the five companies for revenue liabilities was £6,141,526. The balance of £520,337 was credited to the Common Fund. This company is entitled to £156,101 (30 per cent.), to which is added £24,474 brought forward. Dividend for the year on the ordinary shares, 1½ per cent.; £45,000 to reserve; carry-forward, £30,656. Capital expenditure during the year, £9,348.

Metropolitan District Railway Co.—This company is entitled to £62,440 (12 per cent.) of the balance of £520,337, and £20,688 brought forward is added. Dividend on the second preference stock, 3 per cent.; £45,000 to reserve; carry-forward, £29,029. Capital expenditure during the year, £2,828.

Central London Railway Co.—This company is entitled to £104,067 (20 per cent.) of the balance mentioned, and £12,079 brought forward is added. Dividends: 3½ per cent. on the ordinary and 4 per cent. on the preferred ordinary stock, leaving £11,147 to carry forward. Capital expenditure during the year, £47,746. The construction of the extension railway between Wood Lane and Ealing Broadway cannot be further proceeded with at present owing to the war. The conveyance of parcels by train and delivery by cycle messenger service from the stations has been discontinued during the year.

City & South London Railway Co.—This company is entitled to 6 per cent. of the Common Fund (£31,220), to which is added £17,245 brought forward. Dividend on consolidated ordinary stock, 1½ per cent. for the year; £25,000 to reserve; £21,266 to carry forward. Capital expenditure during the year, £11,142.

Yorkshire Electric Power Co.

The net profit for 1917, after payment of mortgage and other interest, was £33,258, against £29,112 for 1916, and £21,209 for 1915. Adding £3,866 brought forward, £37,124 is available. After paying 6 per cent. on the preference shares, 5 per cent. on the ordinary, as against 3 per cent. last year, and putting £12,000 to general reserve, £4,391 is to be carried forward. The company continues to make substantial progress. During the year there have again been material increases in the cost of labour and supplies. In November last a 6,000-kw. turbo-alternator was put on load, and an additional machine of the same output has been ordered, and is now being erected. To meet the cost thereof, and of considerable extensions to the company's plant and mains in the southern portion of the area of supply, the Ministry of Munitions have agreed, in addition to the £60,000 mentioned in the last annual report, to lend to the company further amounts not exceeding £122,000, which will be secured on the plant and mains so erected. The demands for electrical energy have been heavy during the year, and large developments in various parts of the company's area are being made which will call for further supply from the company's mains. To enable these developments to be dealt with, the directors have secured a site at Ferrybridge, near Knottingley, on which to erect a generating station with large units of plant. Of the £71,640 of 6 per cent. cum. pref. shares authorised in September, 1916, £18,750 is still available. 98 members of the staff have joined the Forces, and eight have laid down their lives.

At the annual meeting of the company, held on Tuesday, the Chairman, after stating that the year's progress was satisfactory, showing an increase of revenue at the rate of 25 per cent., reviewed the progress made during the last 12 years. Year by year the rate of progress had accelerated, indicating a fuller appreciation of their service by old customers, and a greater readiness to make use of it on the part of others. It was reasonable to anticipate that future progress would be much more rapid. The powers of the company under their Act were twofold; first, to supply in bulk to districts in which electric distribution powers had been granted to local authorities and others, and secondly, to supply power in districts where there were no authorised distributors. Unfortunately, under their Act they were not empowered to supply current for lighting except in connection with power. The allied company—Electrical Distribution of Yorkshire, Ltd.—had therefore undertaken this duty, and with the approval of the local authorities concerned held lighting orders in 24 areas, with a population of 330,000, which otherwise would be without this necessity of modern existence. Their business was increasing, though some of their Orders were held up owing to the war. Experience had shown that a multiplicity of distributing authorities did not make for economy; as a consequence, 14 local authorities in their area who had obtained supply powers allowed them to lapse, eight others transferred them to Electrical Distribution of Yorkshire, Ltd., and, in addition, seven local authorities and one company were taking a bulk supply from the Power Co. Bulk supply was steadily growing, though it had not developed so rapidly as the power supply business, in which the company dealt with the user direct. At present their mains were fed from three stations, at two of which the generating plant was now being extended, and would continue to be so as need arose, but they had to look to the future and the much larger demands that were before them. The future cost of electricity supply depended on generation on a large scale on sites chosen so that the fullest benefit could be obtained from the use of large generating units. Such power stations as would be needed for the future should, on the score of health and on account of the value of land, be situated outside the large towns and in proximity to the coalfields, and they must, to obtain the full efficiency of the modern steam turbine, be adjacent to an ample supply of water. The West Riding was well supplied with streams, though, individually, on a rather small scale compared to the requirements of modern central generating stations, so that the directors had felt it necessary to look ahead. They had arranged to acquire a site and erect a station at Ferrybridge, where the water supply and the proximity to the coalfields would enable large generating units to be installed and worked under the most economical conditions. During the war they had been called upon to supply power to various munition works, and had been able to give them valuable assistance in the saving of time as well as money. Owing to their supply, the country had made a clear saving during the year of the consumption of some 50,000 tons of coal, and of the extra smoke and dirt which would have been spread over the country and fouled the atmosphere. The treatment of coal so as to extract its valuable chemical constituents, as well as to use it for power purposes, was a problem which was engaging the attention of the Government, the coal and chemical trades, and others, and in this new development the company was actively assisting. The problem was such an important one that all the interests involved should work together, each taking its part, and the company looked for a further development of the co-operation with colliery owners, of which an instance was found in the utilisation of coke-oven gas at the company's Barugh power station. The company's area of supply included the great Yorkshire coalfield with an annual output of some 40 million tons, and in which some 400 mines were being worked. Practically the whole of these mines were outside the large towns, and the company's system was the obvious means of conveying power generated in the coalfields to the various industrial areas. The collieries themselves were already important users of the company's supply to the extent of over one-third of the total output, and the growing appreciation of the advantages of co-operation between collieries and the company should lead to a large increase of this business. Great developments were also taking place in the iron and steel industries, and preparations were being made for the time when peace might be restored. These developments would provide a demand for every unit of electricity that they could generate, and their company must be prepared to take its part with a full hand when the time came. Referring to the report of the Coal Conservation Sub-Committee of the Ministry of Reconstruction, a commission, the Board of Trade Electric Power Supply Committee, was now sitting to consider how the desired results could be best attained. It was impossible to say what form their report would take, but there was no doubt that the national waste inseparable from small separate installations must be obviated. He had every confidence that the work in this direction which had been done by this company would meet with recognition. One solution of the problem would be co-operation between the installations of the large municipalities in their area and this company, the smaller stations being gradually closed down, and taking their supplies from a few large installations which should be worked on the most scientific basis for economy of coal consumption and the reclamation of by-products

They had tried to obtain co-operation in this direction, and would welcome it; if the electrical installations could not arrange it amongst themselves, he believed it would be forced upon them. Already they were working in concert with the city of Bradford, and they hoped to greatly extend that agreement to their mutual advantage, and they were endeavouring to enter into similar working arrangements with other cities. These new departures would call for very large extensions on the part of their company, but when the time came he felt confident that he might count on the support of the shareholders. Plans and estimates for the Ferrybridge station were being prepared, and when they were ready they would be asked to sanction the further issue of capital. The scheme was a big one. When it came before them he would ask them to remember that they had now established their business on a large scale, that they had a growing revenue, and that with increase of output would come relative reduction in the cost of generation and of standing establishment costs. When the war came to an end the country would have before it the task of reconstructing its industries to obtain the greatest possible output for labour, and for this there was nothing more important than a supply of power, which would render every man's labour more efficient, and enable wages paid to be based on output, as in America, where so much greater use was made of horse-power per head than in this country, and where they had recognised that it was the output per head that enabled higher wages to be paid than they had been accustomed to in this country.

Electrical Distribution of Yorkshire, Ltd.—Net profit for 1917 £3,693, against £3,495 in 1916 and £3,638 in 1915. Including £730 brought forward, the disposable balance is £4,423, out of which 6 per cent. dividend (free of tax) is paid on the ordinary shares, and £696 is carried forward subject to directors' remuneration. Under war conditions the results are satisfactory. Parliament has confirmed the granting of provisional orders for Featherstone, Garforth, Horbury, Otley, Penistone, and Rawdon, but they will not come into force until after the termination of the war. In order to provide for the development after the war of the districts for which Orders have been obtained, and to make extensions in those districts in which supply is now being given, the directors recommend the increasing of the nominal capital from £50,000 to £100,000.

Lancashire United Tramways, Ltd.—The result of working of the combined undertaking shows traffic receipts £124,825, electrical energy sold and miscellaneous receipts £16,389, making £141,214; less working expenses, £70,093; cost of generating energy sold, £10,480; general charges (including direction, management, &c.), £5,977; rent of leased lines, £5,191; leaving £49,473, which added to dividend on holding in the New St. Helens & District Tramways Co. £3,068, makes a combined profit of £52,541. The receipts, compared with the previous year, show an increase of £32,942. The traffic earnings per car mile amounted to 14.73d. The increase in expenditure amounted to £13,506, which was principally due to increases in wages under arbitration awards and to the high price of materials. To meet these increased charges the directors in September last raised the fares on the system. Agreements have been entered into with the Lancashire Electric Power Co. and the Leigh Corporation, whereby the three electrical systems are linked up for the purposes of reciprocal supply. The interest and dividends received by the company from the operating companies, together with sundry receipts, amounted to £21,985. After deducting interest in the prior lien debenture stock, income-tax and expenses, there remains a balance, out of which the full interest of 5 per cent., less tax, will be paid on the second mortgage debenture stock for 1917, £68 being carried to depreciation account.—*Financial Times.*

Electro-Bleach & By-Products, Ltd.—Further interim dividends on account of the year 1917 of 3½ per cent., less tax, on the preference shares (making 7 per cent. with the interim dividend paid in September last), and of 10 per cent., less tax, on the ordinary shares. The negotiations between the company and the Government in regard to the duties payable under the Finance Acts and the Munitions of War Acts have made considerable progress, and the directors hope that there will not be much further delay before they are in a position to issue the balance sheets for 1916 and 1917. The directors are again satisfied with the progress made, but do not think it likely that they will recommend the payment of further dividends on account of the two years in question.

Smithfield Markets Electric Supply Co., Ltd.—The gross profit for 1917 was £2,268, against £3,797 for 1916, and the net profit was £1,101, compared with £2,467. £500 has been written off "alteration of pressure" account, and £400 placed to debenture stock redemption fund. The balance remaining, including £1,013 brought forward, is £1,214, which is to be carried forward. Mr. G. E. Leon has been appointed an additional director.

British Insulated & Helsby Cables, Ltd.—The directors have decided, subject to the sanction of the Treasury being obtained, to recommend to the shareholders that the company's capital should be increased to such an extent as to enable the issue to be made to the shareholders of one fully-paid ordinary share for each ordinary share held by them.—*Times.*

Llandudno & Colwyn Bay Electric Railway Co., Ltd.—Profit balance £4,874, including £157 brought forward; £1,695 is put to sinking fund instalment; dividend 3 per cent.; carrying forward £197.

National Electric Supply Co., Ltd.—Gross profits £13,825; to reserve for depreciation on machinery, &c., £5,000. Dividend 3s. 6d. per share, making 6s. for the year, carrying forward £160.

National Boiler & General Insurance Co.—In addition to the interim dividend of 12s. per share, the directors recommend a dividend of 13s. per share, less tax, putting to investment reserve £6,748, and carrying forward £1,393.

Globe Telegraph & Trust Co., Ltd.—Interim dividend, 2s. per share, free of tax, on ordinary shares for quarter.

Fife Tramway, Light & Power Co.—Profits for the year, £31,278. Dividend on the ordinary shares at 5½ per cent. per annum, less tax; to reserve, £10,000; carry forward, £8,390. The construction of the tramways from Dunfermline to Rosyth was commenced in September last, at the request of the Lords Commissioners of the Admiralty, and they will be ready for service in a few weeks. It will be necessary in the near future to make an issue of debenture stock to meet the balance of the cost of the construction of the Rosyth tramways, and to provide for the further plant required by the growth of the company's undertakings.

Mather & Platt, Ltd.—The net profits, after charging depreciation, and making provision for doubtful debts and losses in exchange, amounted to £168,487. There has been transferred to income-tax equalisation £35,000, leaving £133,487, plus £86,514 brought forward, less £5,000 to employés' benefit fund. The directors recommend a dividend for the last half-year of 12½ per cent. on the ordinary shares, making 17½ per cent. for the year, less tax, carrying forward £95,001. The large carry-forward is arranged in view of demobilisation and reconstruction after the war. The company's assets in Russia have been written down to the present nominal rate of exchange.

Traction & Power Securities Co.—Net revenue £28,499. A dividend of 6s. 6d. per share, free of tax, absorbs £27,758, leaving £9,908 to be carried forward. The investment in the Mersey Railway Co. debenture stock remains unchanged. The position of the Clyde Valley Electrical Power Co. has further improved. Dividends aggregating 2½ per cent., free of tax, were paid on its ordinary shares. The company has realised its holding of Clyde Valley preference shares and a small part of its ordinary shares, along with certain other holdings, and has advanced £80,000 to the Clyde Valley Electrical Power Co. on loan.

Mersey Railway Co.—The report for 1917 states that the total amount available for payment of interest is £48,249, which has been applied to payment of interest at 4 per cent. on the 1866 debenture stock, 3 per cent. on the 1871, 1882/3/5 debenture stocks, and 1 per cent. on the "B" debenture stock, leaving £195 to be carried forward.

Llanelly and District Electric Lighting & Traction Co., Ltd.—Available profit, including £1,483 brought forward, £15,185. After providing for debenture interest and redemption, writing £1,100 off machinery, putting £3,000 to reserve and renewals, and paying the preference interest, 4 per cent., less tax, is to be paid on the ordinary shares, and £1,331 carried forward.

Westminster Electric Supply Corporation, Ltd.—Total connections increased during 1917 from 43,969 KW. to 48,084 KW. After allowing for depreciation, sinking fund, and other charges, and the 4½ per cent. preference dividend, 9 per cent. for the year on the ordinary shares is paid, leaving £13,267 to carry forward. Units sold, 27,813,326, including A.C. supply of 1,392,805; used on works 284,632 units; total, 28,097,958.

City & South London Railway Co.—At the annual meeting, Lord Stuart of Wortley said that had it not been for the war the railway would have been reconstructed and a standard type of tube trains, with modernised carriages, would have been introduced. At present nothing could be done. The system was the pioneer of tube railways, and its rolling stock and equipment should now be renewed completely.

Bruce Peebles & Co., Ltd.—A petition has been presented at the instance of the company asking the Lords of Council and Session to order meetings of members and debenture holders to be held for the purpose of considering and approving a scheme of arrangement specified in the petition.

Cambridge Electric Supply Co., Ltd.—The total profit for 1917 was £8,072, plus £2,606 brought forward. After deducting debenture and other interest £1,772, and placing £1,500 to depreciation fund, a dividend of 5 per cent. is paid for the year, carrying forward £2,947.

Liverpool Overhead Railway Co.—Dividend on the ordinary shares 3½ per cent. for 1917, carrying forward £6,929. Passengers carried 16,609,337—a slight decrease. Gross revenue, £120,870; working expenses, £89,806.

France.—La Société des Trefileries et Laminoirs du Havre is increasing its capital from £1,000,000 to £1,800,000.

South Metropolitan Electric Light & Power Co., Ltd.—The revenue account for 1917 shows a credit balance of £55,163, plus £7,249 brought forward, and £1,002 dividend of 10 per cent. on the company's holding in the West Kent Electric Co., Ltd. After paying debenture interest less interest received, 7 per cent. on the first preference shares, and 6 per cent. on the second preference, £18,650 is put to depreciation fund, and 6 per cent., less tax, is to be paid on the ordinary shares, £7,626 being carried forward. The number of consumers increased from 6,985 to 7,111; H.P. connected rose from 21,411 to 23,905 H.P.; gross revenue advanced from £95,883 to £131,930; expenditure from £45,373 to £76,767; net revenue from £50,510 to £55,163. A further substantial improvement is shown in gross revenue, but the expenditure has been largely increased by the high price and unreliable quality of coal, while freights have been exceedingly high. The second 5,000-KW. turbo-alternator was put to work last August. The revenue of the West Kent Co. has increased from £27,677 to £45,139, and the net revenue from £5,432 to £7,012. Mr. H. B. Renwick has been appointed a director.

St. James's & Pall Mall Electric Light Co., Ltd.—During 1917 the connections increased from 16,631 KW. to 17,253, and 11,986,051 units were supplied to consumers. (The Central Electric Supply Co. has determined to pay no dividend on its shares for 1917). The net profits are £27,692, plus £2,595 brought forward. After paying 7 per cent. on the preference and 9 per cent. on the ordinary shares for the year, £5,286 is to be carried forward. Units generated by steam plant, 504,909; purchased, 15,137,913. Sold for private supply, 11,986,051; works, 283,495; batteries, 236,016; transmission and transformation, 2,516,369; distribution, &c., 620,891. Total connections, 17,253 KW.

Blackpool & Fleetwood Tramroad Co.—Dividend 4½ per cent., making 6½ per cent. for the past year.

STOCKS AND SHARES.

TUESDAY EVENING.

THE main business in the Stock Exchange markets this week has once more centred around industrial shares and miscellaneous issues of various kinds. Interruption to postal services has again been caused by the familiar air-raid performances, and business thereby checked in many markets of the Stock Exchange, so there is not much going on. More interest is taken in getting away early o' nights than in dealing in securities; some people, in fact, saying that they would prefer for trade to go slowly during the bright evenings, in order that they might leave the city early.

Two of the principal West-End electric lighting companies have issued their reports, and both are good. The Westminster Electric Supply Corporation announces an increase in the sales of current which has brought in £275,000, some £57,000 more than in the preceding year, and the gross receipts of £306,000 are £43,600 up. Increased expenditure is naturally a feature, and the net revenue comes out at £88,200, showing an increase of £22,600. The dividend is raised from 7 per cent. to 9 per cent. for the year, and the carry-forward of £13,300 is £10,000 up.

The St. James's & Pall Mall Co. secured a net profit of £27,700, an advance of about £5,000 as compared with 1916. The carry-forward of £5,300 is just double that of the previous year, and in this case also the dividend is increased from 8 per cent. to 9 per cent. St. James's stand at 7⅞, Westminsters Ordinary at 7, and the yields on the shares to an investor at the present prices come to £6 4s. 2d. and £6 8s. 7d. respectively. County of London Preference improved to 11¼, and the market generally is a good one, hopes naturally being current that other companies will follow the excellent example set by the St. James's and Westminster undertakings.

Home railway issues show no further sign of vitality. Prices, in fact, are dull and heavy. Underground Incomes receded to 80½, at which the return to a buyer is over 5 per cent., allowance for the £2 net of dividend included in the present price. The Ordinary shares are down ⅛ at 1¼. There is no improvement in the other Undergrounds, the market as a whole remaining dull in sympathy with that for the stocks of the steam companies. Central London Assented have reacted.

The best feature of the electrical markets is the noteworthy strength of manufacturing shares. The air is thick with rumours. Just as a matter of interest, we may repeat the report which links the General Electric Co. with Vickers, and which allies Fraser & Chalmers with one or other of the manufacturing concerns. That there are negotiations proceeding between some of these companies would appear to be beyond doubt, and anticipation is kindled to a high degree as to what developments may shortly be announced.* Meanwhile, it is extremely difficult to get hold of shares. General Electric Ordinary at 19⅛ are 5s. higher. Henleys and Callenders are both 10s. better at 17½ and 15½ respectively. British Insulated at 3¾ are harder. Telegraph Constructions gained £1 at 43. British Westinghouse Preference are ¼ up at 2 15/16. The movement has spread to others of kindred character. Babcock & Wilcox at 3 5/16 are 1/16 to the good. Other industrials are firm to strong, and their market is the only one in which there is anything approaching animation.

Oriental Telephones have further risen to 4½, and the cable market as a whole keeps good without showing any particular movements on the week. Marconis have quieted down again. Several of the subsidiaries are a trifle easier. Americans, for instance, eased off to 25s. Globe Telegraph & Trust Ordinary and Preference are both ½ harder at 14½ and 10½ respectively.

In the foreign group there is not much going on. Mexicans are passive, as ever. British Columbia Electric issues hold their improvements, and one or two of the debenture stocks of the Anglo-Argentine Tramways are in request. Singapore Trams have gone back a little. A remarkable rise has occurred in the Ordinary shares of the Lancashire United Trams. The price has risen to 4s. 6d., whereas quite lately it stood at half-a-crown and less. British Electric Tractions are better, the Ordinary at 34, and the 6 per cent. Participating Preference at 74. Shawinigan Rights are changing hands freely between 6d. and 9d.

The rubber share market is somewhat dull, with business proceeding on retail lines. Armaments are mostly better, on amalgamation rumours. Base metals keep strong, Australians particularly so. Hydro-Electrics are less buoyant, but the price keeps fairly steady at 13s. Victoria Falls ordinary at 18s. 1½d., and the preference at 22s. 9d., are hardly affected by an easier tendency amongst South African mining shares.

[* A reference to this matter appears in our "Business Notices" to-day.—EDS.]

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Feb. 19, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref..	4½	4½	3⅝xd	—	6 18 6
Chelsea	4	3	3¼	—	5 4 4
City of London	8	8	13½	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 12 6
County of London	7	7	11¼	+ ⅛	6 4 5
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	6⅜	—	5 11 7
London Electric	3	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	3⅜	—	5 12 6
Metropolitan	8	8	8⅝	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	3⅝	—	6 18 4
St. James' and Pall Mall ..	8	8	7⅞	—	6 4 2
South London	5	5	3	—	6 18 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	7	—	6 8 7

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	6	6	94½	—	6 7 0
do. Def.	33/6	1½	19⅜	—	6 13 4
Chile Telephone	5	5	7½	—	5 10 4
Cuba Sub. Ord.	5	7	9½	—	*7 11 4
Eastern Extension	8	8	15⅜	—	*5 6 9
Eastern Tel. Ord.	8	8	152½	+1	*5 5 7
Globe Tel. and T. Ord.	7	7	14½	+ ¼	*4 18 3
do. Pref.	6	6	10½	+ ¼	5 17 1
Great Northern Tel.	22	24	30	—	6 11 6
Indo-European	13	13	51½	—	6 6 8
Marconi	10	15	3⅝	—	4 16 1
Oriental Telephone Ord.	10	10	4½	+ 1/16	2 17 2
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Pan.	6d.	6d.	1½	—	*2 16 2
Western Telegraph	7	8	15½	—	*5 5 0

HOME RAILS.

Central London, Ord. Assented	4	4	62½	−2	6 9 1
Metropolitan	1	1	22½	— ½	4 10 0
do. District	Nil	Nil	15⅝	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	— ⅛	Nil
do. do. "A" ..	Nil	Nil	5/6	—	Nil
do. do. Income	6	4	80½	— ½	*4 19 5

FOREIGN TRAMS, &c.

	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4¾xd	+ ¼	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	3⅜	—	—
do. 2nd Pref. ..	5½	—	2⅛	—	—
do. 5 Deb. ..	5	5	66	—	7 11 6
Brazil Tractions	4	4	45	- 1	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Ry. Pfcs.	5	5	46	—	10 17 4
do. do. Preferred	Nil	Nil	33½	+1	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	60	—	7 1 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	32½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	38	—	—

MANUFACTURING COMPANIES.

Babcock & Wilcox	15	15	3 5/16	+ 1/16	4 10 4
British Aluminium Ord. ..	7	10	1½	—	6 0 9
British Insulated Ord.	17½	20	3¾	+ ¼	5 6 8
British Westinghouse Pref. ..	7½	7½	2 15/16	+ ¼	5 2 0
Callenders	20	20	15½	+ ½	6 9 0
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	23	20	3 5/16	—	5 12 2
Edison Swan, fully paid ..	—	—	2⅝	—	Nil
do. do. 4 per cent. Deb.	4	4	76½	—	5 6 0
Electric Construction	7½	7½	1 1/16	— 1/16	6 6 4
Gen. Elec. Pref.	6	6	10½	—	5 15 8
do. Ord.	10	10	19½	+ ½	5 2 7
Henley	25	25	17½	+ ½	7 2 10
do. 4½ Pref.	4½	4½	4	—	5 12 2
India-Rubber	10	10	14⅞	.	*6 5 7
Telegraph Con.	20	20	43	+ 1	*5 11 9

* Dividends paid free of income-tax.

RUSSIAN ELECTRICITY WORKS STATISTICS FOR 1914.

The following statement of electricity works statistics for 1914 is issued by the *Elektrichestvo*, the official organ of a number of Russian technical and electrical associations. Its publication has been, of course, delayed by the state of war. Nevertheless an effort has been made to make the statement fuller than previous ones, even to the inclusion of data on stations, of which particulars are not available later than for 1908 and some later years previous to 1914. The compilers of the statement have had to be content with such particulars as the owners or managers of the respective plants have been pleased to fill up in the forms sent them. Errors and omissions, particularly the latter, originate therefore more probably with the station owners or managers, than with the compilers.

	Place.	Supply authority.	Year of opening.	Supply pressure. Volts.	Frequency and phase.	Total capacity of plant in kw.	Total connections in kw.	Units sold for all purposes per annum.
1	Armavir	Armavir Electricity Co.	1905	220	Direct	565	726	433,125
2	Baku, White Town	Electric Power Co.	1900	1,000 and 2,000	3-phase	36,500	80,257	108,870,260
	Bibi Eybat	Electric Power Co.	1900	2,000	—	11,000	13,733	16,053,161
3	Berdicheff	A. R. Chari, Councillor	1901	2 × 110	Direct	290	558	450,000
4	Bogorodskoye (Nizhegorod)	G. A. Feldman, Engineer	1913	——	—	—	499	165,514
5	Byelgorod	Town	1911	2 × 220	Direct	250	—	216,489
6	Voronesh	Russian Siemens & Halske Co.	1899	2 × 120	1-phase	2,000	1,264	1,027,739
7	Glazoff	Town	1912	——	Direct	230	—	—
8	Eupatoria	Town	1912	2 × 220 ltg.; 550 tr.	Direct	—	972	324,185
9	Eisk	Town	1912	2 × 220	Direct	—	239	174,800
10	Ekaterinoslaff, Ltg. & Try.	Central Electric Co.	—	2 × 250	Direct	—	6,528	7,380,460
11	Elabug	Town	1913	2,000/110	1-phase	—	109	115,635
12	Kazan	Town since March 1, 1914	1896	2 × 150	Direct	—	2,929	1,566,552
13	Kostroma	Town	1912	2 × 220	Direct	—	668	492,288
14	Kremenchug	Belgian Electric Tramways, &c., Co.	1899	550 tram., 2 × 115 ltg.	Direct; 1-phase 50 ~	—	2,744	1,359,307 besides trs.
15	Lebedin	Town	1910	——	Direct	—	107	100,862
16	Lugansk	Town	1913	220	3-phase	3,150	—	—
17	Moscow (Tramways)	Town	1907	600	Direct	6,600	56,860	58,280,522
18	Moscow „ (1886 Co.)	1886 Electric Lighting Co.	1897	2,110/120; 6,600 for long dist.	3-phase	—	103,034	89,799,049
19	Nachichevan on Don	Town	1910	2 × 220; 500 for st. ltg.	Direct	—	1,202	767,766
20	Odessa	Electricity Co.	1912	6,000/217; 10,000/375 for long distance; 120—220	3-phase	—	12,258	6,202,323
21	Orenburg	Town	1898	2,000/120	1-phase	—	1,321	714,349
22	Pernau	Town	1907	2 × 230	Direct	—	527	164,600
23	Petrograd (Tramways)	Town	1907	600	3-phase	6,600	—	38,583,588
24	Petrograd	Belgian Electric Lighting Co.	1898	110—120	42·5 ~; 1-phase	2,200	30,490	27,689,680
25	Poti, port	Town	1906	2 × 250	Direct	500	210	93,200
26	Pskoff	Town	1907	2 × 250	Direct	—	1,474	1,075,476
27	Reval	Town	1913	——	3-phase	2,000	1,318	657,960
28	Rybinsk	Town	1907	2 × 220	Direct	—	920	469,775
29	Simferopol	Belgian Simferopol Electric Trams. and Lighting Co.	1914	217 and 125; 550 for tramways	Direct	6,600	1,981	949,760
30	Stavropol (Caucasus)	Town	1900	2 × 250; 2 × 500	Direct	—	1,043	551,506
31	Suchum-Kale	Suchum Electric Co.	1909	3,300/125; 500 for street ltg.	3-phase; direct	—	347	384,249
32	Tomsk	Technico-Industrial Bureau and Tomsk Electric Lighting Co.	1896	110—115	1-phase; 50 ~	2,200	—	614,774
33	Uman	Russian Electrical Equip. Co.	1914	3,000/200	50 ~; 3-phase	308	171	55,265
34	Karkoff	Town	1896	2 × 125 ltg.; 250 for motors; 600 for trams. and street ltg.; 3 × 190 and 110	Direct and 3-phase	—	10,357	8,164,722
35	Alexandrovsk	Town	1910	2 × 230	Direct	500	712	413,302
36	Warsaw (Tramways)	Town	1908	——	Direct	6,000	8,832	8,559,800
37	Grodno	Town	1912	2 × 220	Direct	—	557	193,540
38	Melitopol	Town	1901	2 × 250	Direct	500	—	344,587
39	Mohilieff Podolia	Electric Light Co.	1912	——	Direct	—	217	108,242
40	Penza	Ya. Milman & Ph. Titoff	1907	220	Direct	—	—	—
41	Petrograd (1886)	Electric Light Co., 1886	1898	2,200/120; 6,000/120	3-phase	—	57,562	53,430,850
42	Riga (Lighting)	Town	1904	——	3-phase	3,000	13,271	6,371,625
43	Rostoff, Yaroslaff	Town	1905	2 × 220	—	410	636	529,895
		Data for 1912.						
44	Balaklava	Town	1911	——	—	—	44	26,000
45	Batoum	Town	1900	2 × 250	—	—	188	224,290
46	Bisk	Electric Light Co.	1900	——	1-phase	—	—	62,500
47	Warsaw (Lighting)	Warsaw Electricity Co.	1903	5,000/125; 2 × 220	50 ~; 3-phase	—	—	11,199,350
48	Wilna	Town	1903	2 × 240	Direct	—	—	1,547,364
49	Vladivostok	Town	1912	2,200/220 lighting and motors; 550—600 trams.	3-phase Direct	—	1,509	1,080,614
50	Vologda	Town	1904	220	Direct	250	92	149,361
51	Ekaterinodar (Lighting)	Town	1906	——	—	—	1,144	1,128,060
52	Ekaterinodar (Tramways)	Belgian Tramway Co.	1900	——	—	—	3,583	2,367,743
53	Ekaterinoslaff (Trams.)	Ekaterinoslaff Tramway Co.	1897	——	Direct	—	—	1,995,000
54	Zhitomir	Russian Town and Feeder Lines Co.	1899	2 × 230 trams. and lighting and 550 tramways	Direct	—	1,156	950,241
55	Irkutsk	Town	1910	375	1-phase	2,000	1,765	1,012,692
56	Kovna	Kovna Electric Lighting Co.	1900	2 × 110	Direct	—	1,001	608,508
57	Kieff	Kieff Town Tramways	1890	——	Direct	600	14,043	13,378,921
58	Libau	Société Cont. de Traction et d'Eclairage par l'Electricité	1899	2 × 220 lighting, and 500 tramways	—	—	3,715	2,133,788
59	Lodz (Lighting)	Lodz Section of the 1886 Co.	1908	3,100/120	50 ~; 3-phase	—	26,011	31,701,417
60	Lodz (Tramways)	Lodz Electric Tramways Co.	1898	——	—	—	—	3,994,300
61	Novgorod Syevyersk	Town Mutual Insurance Co.	1901	——	Direct	500	—	56,000
62	Novocherkask	Town	1900	2 × 110	Direct	—	866	588,689
63	Pavlovsk	Pavlovsk Electric Co.	1911	2 × 240	Direct; 3-phase	—	162	103,075
64	Petrograd	Petrograd Electric Equip. Co.	1897	——	—	3,[illegible]03	—	22,90[illegible],666
65	Poltava	Town	1900	2 × 125, & to add 2,100/190/110	Direct	—	658	411,043
66	Rostoff on the Don: Lighting	N. V. Smirnoff, engineer	1909	——	50 ~; 3-phase	2,000	2,376	—
67	Rostoff on the Don: Tramways	Belgian R. o/D. Electric Tramways Co.	1901	550 tramways	—	550	4,000	3,041,000
68	Smolensk	Smolensk Electric Co.	1901	550 trams.; 2 × 220 lighting	Direct	—	1,573	1,032,148
69	Tver	Tver Elec. Tram. & Light Co.	1901	2,400 for trams.; 110 lighting	Direct; 3-phase	—	1,319	605,294
70	Chabarovsk	Electric Power Co.	1906	2 × 220	Direct	—	767	496,700
71	Kerson	Town	1908	2 × 375	Direct	—	1,125	718,773
72	Tzechotzinsk Health Resort	Tzechotzinsk Treasury Water Cure Establishment	1903	——	Direct	—	—	26,240
73	Chernigoff	Town	1893	2 × 220	Direct	—	542	260,490
74	Yalta	Town	1904	2 × 220	Direct	—	880	466,000
		Data for 1908–1911.						
75	Elizabetgrad	Town	1908	2 × 220	Direct	—	—	680,294
76	Minsk	Town	1904	——	—	—	—	638,781
77	Nikolaieff	Town	1902	2 × 220	—	480—600	—	1,888,967
78	Yaroslavl	Town	1900	2 × 230	—	—	2,189	(1,510,000)
79	Byelostok	Berlin Electrical Concerns	1910	——	—	—	1,114	697,362
80	Vladimir	K. A. Russakoff, Engineer	1908	2 × 220	—	—	—	106,330
81	Viatka	Town	1903	2 × 230	Direct	—	966	553,852
82	Kishinieff	Town	1909	2 × 220	Direct	—	671	423,000
83	Nikolsk Ussurisk	Ussurisk Electricity Co.	1908	——	Direct	—	302	231,000
84	Upha	N. V. Konshin	1898	2 × 220	Direct	—	607	430,860
85	Chita	N. P. Polyakoff & Co.	1906	2 × 250	Direct	—	500 (about)	36,000 (about)
86	Astrachan (Tramways)	Private	—	——	Direct for trams.	—	—	1,424,[illegible]
87	Berdiansk	Town	—	2 × 220; 540, street lamps	Direct	—	125	134,869
88	Kieff	Private	—	2,300 to 190, & to 2 × 110 alt.	3-phase; direct	2,200; 500	14,271	10,946,507
89	Taganrog	Private	—	2 × 110	Direct	—	(151)	40,000
90	Perm	Town	—	2 × 220	Direct; 3-phase	—	1,192	722,611
91	Radom	Private	—	2 × 220; 2,200/110	Direct	—	511	401,000
92	Riga (Tramways)	Private	—	——	—	—	—	—
93	Samara	Town	1899	2,000/120	3-phase	—	372	222,445

CO-OPERATION FOR AFTER-WAR EXPORT TRADE.

We make the following extracts from an important article in the series on "After-War Trade" appearing in the Board of Trade *Journal*. The matter is referred to in our leader columns to-day:—

In the course of their inquiries, the After-War Trade Departmental Committees considered the instruments which the commercial nations of the world have created for the distribution and export of products and the expansion of trade. Their purpose was to determine, as far as they could from the evidence before them, how far our own existing trade methods were likely to be effective after the war; to consider the strength and character of future competition, and to determine whether any changes in our trading methods are expedient.

The export trade of the United Kingdom has been built up by individual effort, and, in consequence, exhibits several varieties of organisation. In great part, the distribution of products in external markets has been the function of merchants who have bought freely from any producer, though in some cases merchants have become attached to a particular manufacturer as his agent or partner, and in other cases the manufacturers themselves have established strong direct connections with individual markets. In spite of the very considerable achievements resulting from these various methods in the past, the Committees were generally of opinion that they called for very careful reconsideration in the light of changed conditions and foreign methods.

The Committee which investigated the Iron and Steel Trades anticipate that competition in external markets is likely to be severe after the war, as a result of the enormous increase in the world's production of steel. They are persuaded that only solidarity of action will enable the iron and steel industries of the United Kingdom to maintain and improve their position in the markets of the world. They approve generally of the principle of concerted action in the commercial distribution of manufactured iron and steel goods. It is possible that in the case of highly specialised products its application might not be necessary, but they are convinced of its value in respect of the bulk of iron and steel products.

Associations of this character are not necessarily of uniform organisation. Thus in the engineering trades, the Committee mention a system of small co-operative limited companies, the capital being subscribed by the interested firms. The sole business of such selling companies is to push certain lines of goods manufactured by the subscribers. The goods sold in each case are mutually non-competitive. Each manufacturer is limited as to the products which he is entitled to have sold through the agency, which thus acts as selling agent for a large number of manufacturers of distinct, though perhaps allied, products. The main criticism of this system made to the Committee was that the agency, having no special interest in any particular product, followed the lines of least resistance, and consequently pushed those goods which met with a ready local acceptance at the expense of the manufacturers whose goods did not sell so easily.

"It appears to us that such selling agencies can usefully be employed in the early stages of a firm's operations in a new country," the Committee state. "When a *clientèle* has been collected, the firm if sufficiently large, may probably find that separate representation will best meet its interests." The whole system of pushing export trade requires a somewhat bolder treatment than it has received up to the present. We believe that the excellence of British goods is everywhere acknowledged, and that if satisfactory arrangements can be made as to the giving of credit in proper cases, and greater attention is given to prompt delivery, the export trade of this country can be very largely increased.

The Committee add:—"In the engineering trades of the United Kingdom the working of trade combinations leaves much to be desired. In the United States such combinations as a rule seem to take the form of amalgamations. In Germany trade combinations take form in the well-known cartels. In the case of both countries the object aimed at is, especially by supporting experimental investigations and scientific departments, to co-ordinate production, to promote efficiency, to eliminate waste, to push home trade, to facilitate export trade, and to unify selling arrangements. In both of these countries the ideal at which trade combinations aim is the maximum of production at the minimum of cost. In this country, so far as we have been able to ascertain from the evidence before us, trade combinations exist only for the purpose of maintaining home prices. Even in this respect they are difficult to keep going, as a violent slump is apt to bring such a combination to an end. Apparently we had in this country before the war few combinations having for their objects the co-ordination of production, the pushing of trade, the elimination of waste, the facilitating of export trade, or joint selling arrangements, though we understand that there are some amalgamations which have to some extent effected this object."

Very emphatic views on the advantages of combination to promote joint interests in the export trade are expressed in the following statement by the Committee reporting on the electrical trades:—

"For several years past there has been in Germany a consistent policy of amalgamation and association, and several establishments of world-wide importance have thus been built up. Only two or three German companies are seriously engaged in the electrical business overseas, and the competition which British manufacturers have to face is almost entirely with these houses. But these competitors, though few, have immense resources, with highly trained staffs and competent workmen, their factories are well equipped, they have established branches all over the world, and maintain elaborate research laboratories. They have enormous financial strength, for, in addition to their own capital, they are closely bound up with leading financial institutions not only in Germany, but elsewhere on the Continent, in a manner which does not exist in Great Britain.

In contrast with this policy of association, which has proved so successful both in Germany and in America, Great Britain has always discouraged combination, fearing a rise in prices to the detriment of the consumer. As a result of this policy of isolated effort, numbers of small concerns have arisen, each struggling against the other for bare existence. By association it would be possible to manufacture each class of apparatus in the most suitable factory, the management of which would thus be concentrated on its own speciality instead of being wasted on a variety of products. It is essential that output should be thus consolidated instead of remaining in the hands of a number of weak concerns, many of which, moreover, have further reduced their competitive power by dabbling in a variety of productions. The Committee is convinced that under properly organised combination or association the cost of production will be materially reduced, and that there is no reason to fear that enhanced prices will be charged to the consumer as a result of such combination.

"If electrical factories, which are unquestionably necessary on national considerations, are to be maintained in a state of efficiency, steps must be taken at the earliest possible moment to deal with the problem. A sound and permanent industry can be established not only to supply the home market, but to secure a much greater proportion of the overseas trade of the world. This can be done either by amalgamation among the companies engaged in the industry or by the development of the practice of association for common purposes. In whichever direction action be taken, the Committee is convinced of the need for reform. Only by the creation of strong combinations will it be possible for Great Britain to compete with the great foreign corporations, which not only manufacture, but undertake comprehensive contracts, make powerful financial alliances, and thus exert in every direction greater influence than is possible in the case of any individual firm."

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Improved Type of Outdoor Terminal Box.

For terminating underground cables at the terminal poles of an overhead transmission line, an inverted type of box is usually employed, *i.e.*, a box from which the insulators point in a downward direction. There are several types of box at present used which answer to this description, and the majority of them are fitted with insulators which require

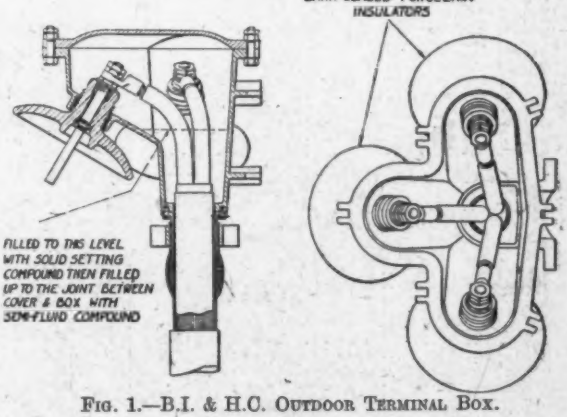
DARK GLAZED PORCELAIN INSULATORS
FILLED TO THIS LEVEL WITH SOLID SETTING COMPOUND THEN FILLED UP TO THE JOINT BETWEEN COVER & BOX WITH SEMI-FLUID COMPOUND

Fig. 1.—B.I. & H.C. Outdoor Terminal Box.

protection from the weather to render them in any way suitable for the work for which they are intended. These insulators are usually shielded by separate castings of bell shape, fixed to the box by screws, or similar means, or a shield is cast solid with the box.

The disadvantage of protecting the insulator in this fashion

is that the efficiency of the insulator is diminished, owing to the radial distribution of the electrostatic field between the conductor and the shield, as compared with a longitudinal distribution of the electrostatic field, more or less parallel to the conductor, when no shield is used; hence there is a tendency to diminish the factor of safety.

It is evident, therefore, that if metal shields are used, apart from protecting the insulators so that the latter can insulate, they should be so far removed from the conductors as will provide a reasonable factor of safety. Obviously, this means, in the case of boxes used on H.T. or E.H.T. circuits, that the shields must necessarily be of large dimensions; consequently the box is large, and the amount of compound liquid required to fill it is considerable.

With a view to getting rid of the disadvantages of metal-shield protection of insulators, and at the same time providing a box with a high factor of safety, but of comparatively small dimensions, the box illustrated in fig. 1 has been developed and patented by the British Insulated & Helsby Cables, Ltd., of Prescot, Lancs. The insulators of this box do not require protection, as they are so shaped that they are self-shielding. The disk formation of the insulator prevents rain from having access to a part of the surface of the insulator which lies between the bare conductor and the earthed box, so that under the worst of working conditions there is always sufficient insulation to prevent a flash-over.

A box designed for working at 11,000 volts was fitted up and tested, with the following results:—

Flash-over, dry	65,000 volts.
Flash-over, wet (under heavy spray) ...	58,000 volts.

In the dry test the arc was over the surface of the insulator, but in the wet test the arc bridged the gap between the lip of the insulator and the box. Considering that this box for 11,000 volts, 3-core cable, is so small that it takes only 26 lb. of compound to fill it, it will be appreciated that these results are highly satisfactory.

The insulators are arranged so that they can be readily replaced in the remote event of breakage, the compound above the fork of the cable being of a semi-fluid consistency. They are also provided with hemp threads, and are screwed into the box, the hemp acting as the male thread. The use of hemp in this way provides a flexible joint, thus obviating the possibility of fracture, due to vibration (Patent No. 105,586/16).

The box is arranged for filling with compound to the level of the machined joint between box and cover, and as the cover is domed, allowance is made for the expansion of the compound which will take place when the box is subjected to heat. Cases are known where boxes have cracked, due to the lack of such provision.

The brass gland for wiping to the lead of the cable is arranged for attachment to the box in such a way that the wiped joint may be made away from the box, and the hole in the box for receiving the gland is of such size that it is possible for the terminals, when sweated to the cable cores, to be passed through. This permits of all the jointing being done on the ground, thus reducing the cost thereof, and simplifying erection.

B.E.V. Electric Industrial Truck.

The British Electric Vehicles, Ltd., of Hoghton Street, Southport, are manufacturing two sizes of electric industrial truck, viz., for half and one-ton loads, but a light and heavy-duty pattern is made for each of these loads. The light-duty

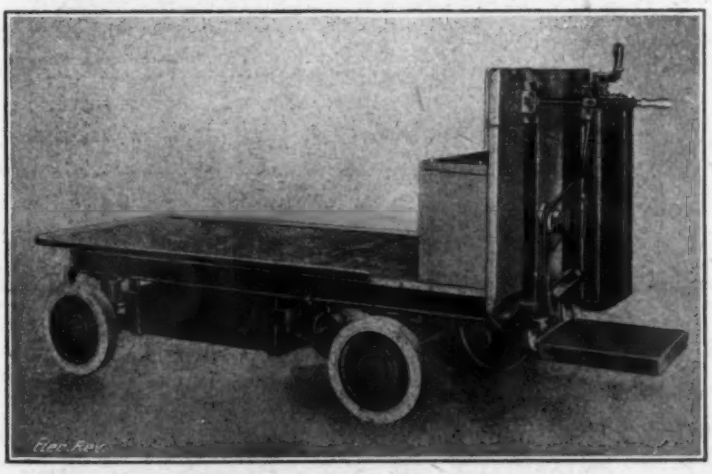

Fig. 2.—B.E.V. Electric Truck.

pattern is intended for level runs on good surfaces, while the heavy-duty type is designed for use on rough tracks, and to climb gradients up to 1 in 20 for the half-ton, and 1 in 10 for the one-ton machine. The loading space for all types is 6 ft. × 3 ft.; 27-cell, 50-volt Chloride "Ironclad" batteries of 60 and 96-ampere-hour capacity are fitted to the half and one-ton sizes respectively. Special ball-bearing motors and controllers with renewable fingers and contacts, giving three speeds in either direction, are provided; the frame is of riveted steel, fitted with solid rubber-tired wheels, chain drive from motor to rear wheel, and the rated speed is six to seven miles an hour, and rated mileage on the level, 20 to 25 miles per battery charge.

These trucks are guaranteed against defective material and workmanship for 12 months, and undergo full tests before dispatch.

REVIEWS.

Manual of Reinforced Concrete. By C. F. Marsh, M.Inst.C.E., and W. Dunn, F.R.I.B.A. London: Constable & Co., Ltd. Price 10s. 6d. net. XVI + 475 pp., 191 illustrations.

This is the third edition of the work, and has been re-written and considerably enlarged. The standard notation proposed by the Concrete Institute for formulæ has been adopted, and a variety of new methods of calculation, new diagrams, &c., has been incorporated in the volume, which now comprises 475 pages.

After treating of the materials employed, methods of construction, and the behaviour of reinforced concrete structures with regard to water, fire, &c., the authors proceed to the discussion of loads, bending moments, and shearing forces on structures of various types, giving abundant data bearing upon the requirements of practical conditions. Many of the subjects dealt with are of immediate interest to central-station engineers, such as the pressures on retaining walls, coal storage bins, &c. This part of the book occupies nearly 100 pages, and is followed by one twice as long, dealing with methods of calculation, with the aid of numerous diagrams which facilitate the quick determination of the required values required by graphical means. The last part gives general information, tables, &c., bearing upon the subject. A prominent feature of the work is the use wherever possible of handy methods by which the evaluation of formulæ is largely avoided, and the time of the user is economised, and the work is evidently intended to meet the needs of the engineer who is actually engaged in the design and erection of ferro-concrete structures. It contains a mass of practical information which should render it indispensable to those concerned in such operations.

Handbook of Machine Shop Electricity. By C. E. Clewell. London: Hill Publishing Co. Price 12s. 6d. net.

This work is a somewhat curious Olla Podrida-like collection of matter. The compiler explains in his prefatory remarks that the book has been prepared primarily for the practical machine-shop man, and is offered as a reference-book and guide to the practical everyday applications of electrical energy in workshop operations. A laudable object, surely, but after a close perusal of the compiler's chosen subjects and his methods of treating the matter one is forced to the conclusion that the really practical average machine-shop man will get somewhat confused in his interpretation of many of the more important branches dealt with, and the reviewer is inclined to think that some of the guidance tendered is not very helpful.

The work is divided into 10 sections, which are further split up into sub-divisions, the various subjects in each section being arranged alphabetically. The explanatory text is generally clear, but there is much redundant matter, and many superfluities and useless repetitions that appear might with advantage have been omitted.

Section 1 is mainly a dictionary of terms, &c. In Section 2 on "Circuits," systems of transmission and distribution are discussed, and the reader is taken rapidly from conduit running to manhole construction, resuscitation from electric shock, screws and nails, &c. Wiring is resumed, and runs on for some 30 pages, when a pause is made to consider Ohm's Law and its practical applications. The matter on costs, in Section 3, can hardly be considered as having any practical value, on this side of the water at least, and the reader is advised to check the prices given against quotations from manufacturers. Section 4 contains quite a lot of interesting reading on communication and control, illustrated descriptions of

many useful devices applicable to everyday shop wants being given herein.

Too much has been attempted in Section 5; the reader is hustled on from questions of efficiency to rheostats, machinery foundations, "grounds," machine details, and thence to parallel operation, stopping a brief spell to look at a picture or two of Edison and other cells, until he arrives breathless at a conventional line diagram of the Scott transformer connection. Following a 12-line description of the function of slip-rings, this chapter ends rather abruptly with a meagre and not very lucid sketch of the static transformer.

Section 6 gives some interesting information about electric soldering and welding, but the data tabulated are not by any means up to date as representing modern shop systems.

The use of the magnet or clapper switch is discussed in Section 7, and some data on the lifting magnet appear. Sandwiched between them one finds mention of magnetised hammers, screw-drivers, and such-like small tools, also wrinkles on the demagnetising of watches, and, later, the extraction of metal particles from the eye is mentioned. The electric heating of various shop tools is described, and magnetic chucks are discussed at some length.

In Section 8, on lamps and shop lighting, the requirements for good factory lighting are considered according to the code of the Illuminating Engineering Society of New York, the 11 articles of the said Society's creed being reproduced *in extenso*. A description of lamps and fittings which follows does not mark any advance by comparison with modern practice on this side.

Measuring instruments and measurements are dealt with in Section 9. Various A.C. and D.C. switchboard instruments, photometers, and pyrometers are shown and illustrated, and a short abstract of an article on shop operations analysed by graphic meters is given. The power-factor indicator is rather summarily dismissed in a brief half column. The voltmeter, watt-hour meter, and wattmeter are collectively disposed of in less than 20 lines of text, notwithstanding the important part played by the indispensable wattmeter in A.C. power measurements. The handy detector galvo., and the universally-used magneto form of insulation-resistance test sets seem to have been entirely overlooked as shop accessories.

The last chapter, Section 10, deals with motors and applications. Some good information on various forms of driving is given, and numerous types of switch control are described. The method of putting fuses on the "live" side of the main switch, as shown, is bad practice. The tabular data on the power required to drive machine tools should be useful to those who have to deal with shop tool layouts. Fourteen pages are devoted to the care of motors, and much advice of a really practical nature is given. Towards the end of this section details of machine design, both A.C. and D.C., are discussed at considerable length, the explanatory sketches being good and clear. The volume ends after disposing of ventilating systems in four pages, no reference being made to the electrically-driven fan or blower as applied to modern foundry-cupola and smithy practice. An index of nearly 2,000 references is provided.

In the opinion of the reviewer this work fails to achieve its avowed object; as an electrical encyclopædia it may have some claim to consideration by the class of reader to whom it is proffered. The compiler and his collaborators have evidently been to no small amount of trouble in collecting material for this compendium, but the technical reading public—on this side of the Atlantic at any rate—in search of daily provender have long been wise in discriminating between collected catalogue matter and really reliable information for the practical engineer. The volume is profusely illustrated, in fact, rather too much so, many of the figures showing external perspectives of proprietary apparatus being more suitable for the respective makers' lists. Many of the illustrations might with advantage be omitted altogether as being in no wise helpful to a comprehension of the text. The A.B.C. classification is irritating, amounting almost to a fetish, and much has been sacrificed thereby. Apart from a few obvious typographical slips the book is a good example of the printer's craft, and is of convenient pocket size, and pleasing appearance externally.—S. L.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

1,988. "Electric switchgear." H. W. Clothier, R. M. Longman and A. Reyrolle & Co. February 4th.

2,006. "Electric conductors." G. Fuller and Fuller Wire & Cable Co. February 4th.

2,018. "Thermic telephones and microphones." Naamlooze Vennotschap de Nederlandsch Thermo-Telephoon Maatschappij. February 4th. (Holland, March 27th, 1917.)

2,029. "Devices for locking incandescent electric lamps, &c., to sockets or holders." H. R. Nixon & W. Peddie. February 4th.

2,030. "Electric contacting devices." A. B. Field, A. C. Heap & Vickers, Ltd. February 4th.

2,031. "Electric contact-actuating mechanism, and systems for employing same." A. B. Field, A. C. Heap & Vickers, Ltd. February 4th.

2,032. "Electrically-controlled devices." A. B. Field, A. C. Heap, and Vickers, Ltd. February 4th.

2,040. "Combined air-cooled ignition plug and auxiliary air inlet for internal-combustion engines." J. Chapman. February 5th.

2,047. "Electric generators." A. H. Neuland. February 5th.

2,051. "Electric flash-preventing device." W. R. Cooper. February 5th.

2,072. "Change-over switch for spare electric transformer, &c." P. J. Monks. February 5th.

2,077. "Electric governing devices." A. Lyon & Wrench, and J. C. Todman. February 5th.

2,081. "Electric fuse boxes." W. T. Henley's Telegraph Works Co. and E. E. Judge. February 5th.

2,089. "Systems of electrical distribution." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 5th.

2,095. "Sparking plugs for internal-combustion engines." L. S. Clarke. February 5th.

2,102. "Filament glow lamp for electric searchlights." V. Burri. February 5th. (Switzerland, January 31st, 1917.)

2,112. "Method of retaining the maximum spark on a magneto with unlimited range of advance and retard." L. Hollins. February 6th.

2,116. "X-ray fluorescent screen attachment for localisation of foreign bodies." W. J. Barnicoat. February 6th.

2,117. "Sparking plugs." M. Lacroze. February 6th.

2,120. "Means for cooling and ventilating electric motors and dynamos." E. Harris. February 6th.

2,134. "Removable electric fuse carriers or connecting devices." British Insulated & Helsby Cables, Ltd., and L. B. Wilson. February 6th.

2,146. "Protection of windings of electric generators, &c." A. Collins. February 6th.

2,153. "Machine switching telephone systems." G. Deakin, J. G. Hackley, L. Polinkowsky, & Western Electric Co. (C. E. Stevens partly and Western Electric Co., U.S.A.) February 6th.

2,164. "Controllers for electric motors." J. C. Kelso. February 6th.

2,184. "Switch or fuse contacts." F. J. Gill. February 6th.

2,208. "Removable electric fuse carriers or connecting devices." British Insulated & Helsby Cables, Ltd., and L. B. Wilson. February 7th.

2,235. "Electromagnetic switches." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 7th.

2,264. "Searchlights." E. A. Sperry. February 7th. (U.S.A., February 7th, 1917.)

2,265. "Electric heating systems." C. R. Matthews, R. J. A. Pearson and Vickers, Ltd. February 7th.

2,287. "Sparking plugs." A. G. France. February 8th.

2,293. "Microphones." P. J. Hackett. February 8th

2,317. "Cleat for supporting electric cables." A. Lappin. February 8th.

2,324. "Electrically-actuated registering mechanism for indicating or signalling systems." E. A. Graham. February 8th.

2,340. "Self-locking electric light fittings, &c." J. P. Annacker. February 9th.

2,348. "Switch apparatus for electric hand lamps, &c." Efandem Co. and A. H. Williams. February 9th.

2,349. "Electric lamps carried by handle projecting therefrom." Efandem Co. & A. H. Williams. February 9th.

2,368. "Electric furnaces." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 5th.

2,380. "Sleeve inductors for ignition magnetos." A. R. J. Foster and Selsdon Aero & Engineering Co. February 9th.

2,384. "Electric cells." C. Fery. February 9th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

15,009. Apparatus for Regulating the Voltage of Dynamos. A. J. Jullin. June 16th, 1914. (Addition to 15,008/16.) (101,888.)

15,010. Apparatus for Regulating the Voltage of Dynamos. A. J. Jullin. July 28th, 1914. (Addition to 15,008/16.) (101,889.)

17,529. Dynamo-electric Machine for the Conversion or Simultaneous Production of Alternating Currents of Different Frequency. Bergmann Elektricitats Werke Akt. Ges. December 8th, 1915. (102,618.)

1917.

686. Magnetic Material Suitable for use in Static Transformers and other Electrical Apparatus. A. F. Berry. January 13th, 1917. (112,649.)

740. Automatic Telephone Systems. Relay Automatic Telephone Co. January 15th, 1917. (112,650.)

749. Phase Transformation of Electric Currents and Transformers therefor. British Electric Transformer Co. & R. Crosbie-Hill. January 15th, 1917. (112,651.)

819. Dynamo-electric Machines. H. F. Josi & F. P. Fletcher. January 16th, 1917. (112,655.)

931. Electric Couplings, and Cases therefor. N. J. Austin & G. E. Taylor. January 18th, 1917. (112,664.)

955. Electric Switches. K. Horn. January 19th, 1917. (112,667.)

4,558. Engine Starter. V. Bendix. March 29th, 1917. (112,702.)

5,292. Electric Regulators. British Thomson-Houston Co. (General Electric Co., U.S.A.) April 14th, 1917. (112,708.)

5,941. Electric Switches. H. B. Butler. April 27th, 1917. (112,711.)

7,092. Electric Fuses. E. G. Nicholls. May 17th, 1917. (112,717.)

7,629. Sparking Plugs for Internal-combustion Engines. R. L. A. Burgognon. May 26th, 1917. (112,720.)

9,169. Electrical Furnace for Hardening Steel and the like. L. W. Wild & E. P. Barfield. June 26th, 1917. (112,731.)

9,558. Electrically-operated Riveting, Pressing, Stamping, and the like Machines. E. Adamson. July 3rd, 1917. (112,733.)

10,710. Prismatic Glassware for Illuminating Purposes. Holophane, Ltd. (Holophane Glass Co., U.S.A.) July 25th, 1917. (112,736.)

10,896. Electric Switches. C. P. Drescher. July 28th, 1917. (112,740.)

14,462. Spark Plugs. H. L. Boudreau. June 2nd, 1917. (112,753.)

Electroculture at Warrington.—The Corporation Electricity Committee and the local Small Holdings and Allotments Committee are to co-operate in a series of experiments in electroculture, which are to be carried out on a portion of the acreage in Victoria Park, which is to be planted with potatoes this spring.